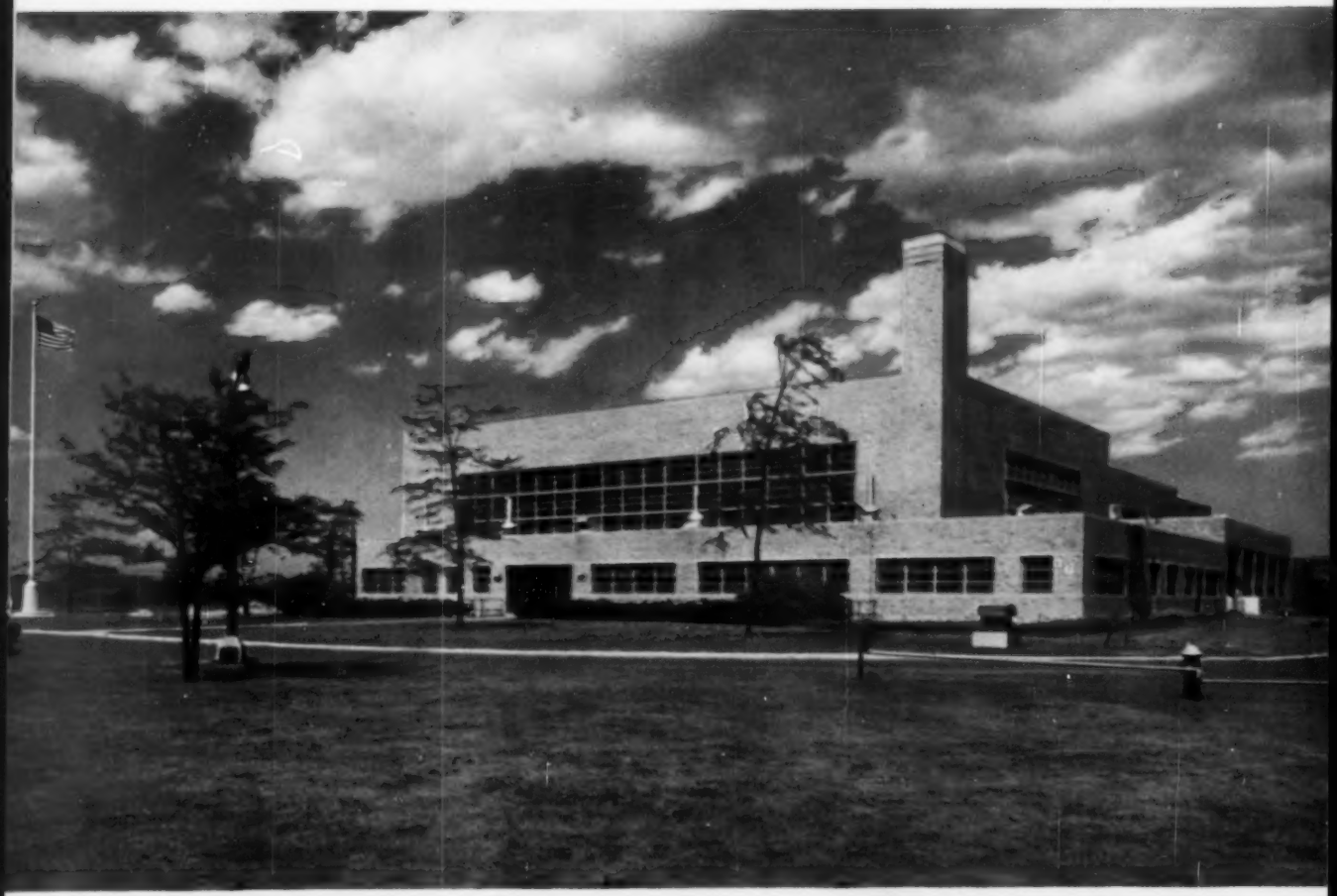
A Scranton Gillette Publication

DECEMBER 1958

WATER & SEWAGE WORKS

WATER SUPPLY SEWAGE DISPOSAL

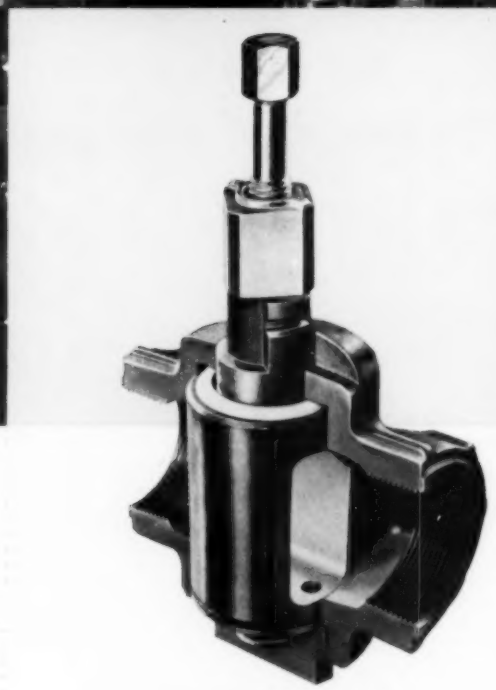


▲ **HUNTS POINT** Sewage Works in New York City treats an average flow of 113 mgd. In operation since 1952, it serves a major portion of The Bronx as part of New York's overall program of Harbor pollution control. Power at this plant is generated by dual-fuel engines, equipped with a new type of oil filter which has reduced operation costs. See page 522.

Future Water Demands—p. 525

Sizing Water Services—p. 530

ACF Lubricated Plug Valves



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*The Havenhurst Interceptor Project

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Chief of Sewer Design Division: E. G. Studley

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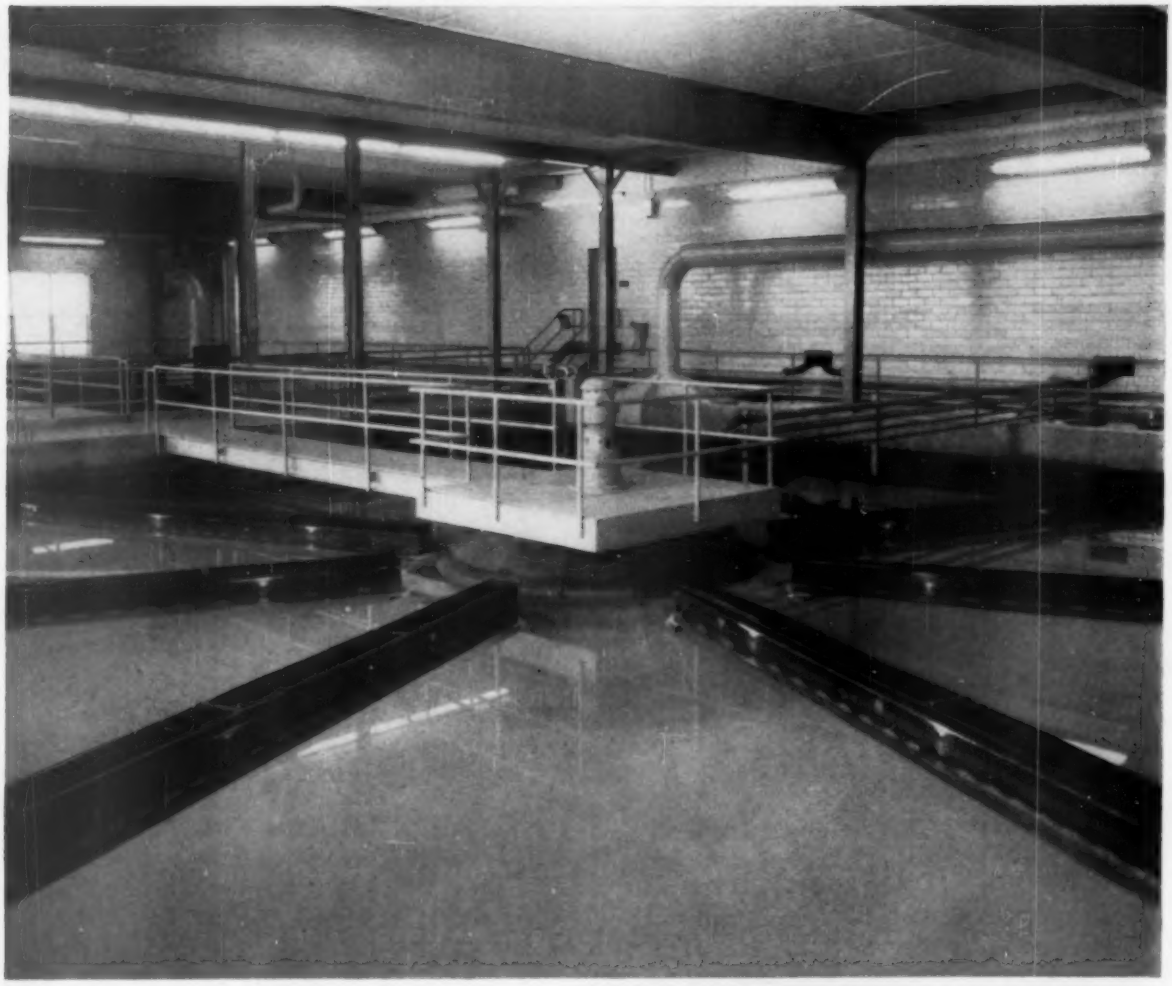

Two Permutit Precipitators treating 12 million gpd at the Eagle Point Water Plant, Dubuque, Iowa. Plant designed by Consoer Townsend & Associates, Chicago, Ill.

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Permutit can help you come up with the right answer to your community's water problems. Just contact the Permutit office listed in your phone book. Or write to us directly. The Permutit Company, Dept. WS-12, 50 West 44th Street, New York 36, New York, or Permutit Company of Canada Ltd., Toronto 1, Canada.

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Vol. 105 No. 12

DECEMBER • 1958

A Scranton Gillette Publication

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WATER & SEWAGE WORKS

SLUDGE GAS UTILIZATION *at Aurora, Ill.*
by Willard P. Pfeiffer 499

FSIWA ACTIVITIES AND ACTIONS
a Meeting Report 506

HOW IS YOUR PLANNING
a Dear Bill Letter 508

CHLORINATION *of Wastewater—Part II of a series*
by Edmund J. Laubusch 509

ADMINISTRATION, *Cost Reduction, Syndets*
a Report on FSIWA Meeting 516

PUBLIC RECOGNITION
a Report on the Ky.-Tenn. Water & Sewage Meeting 520

OIL FILTERS *on Sludge Gas Engines*
a Staff Report 522

FUTURE WATER DEMANDS
by A. H. Gent 525

SIZING WATER SERVICE PIPING
by Arthur Rynders 530

OXYGEN IN WATER, *a nomograph on solubility*
by Harry C. Ways, and D. S. Davis 537

POLYPHOSPHATE TREATMENT
by Davis E. Speeg 538

PLASTIC PIPE *for Water Distribution*
by H. M. McDaniel 541

News—Here & There 7A
Equipment News 11A
New Bulletins 25A
News of Suppliers 27A
Meeting Calendars 96A

Frank J. Schwemler, Commissioner of Water
Consulting Engineers—Havens and Emerson
Prestressed Concrete pipe by Price Brothers

Cleveland...

...uses Pratt Valves in a tight spot

City installations, with limited clearances and traffic problems, are never easy. This Cleveland project, tying a new booster station into two distribution lines, is about as tough as they come.

Here the specifications could not call only for "dependable valves" . . . it had to be "*dependable valves that are easy to install.*" This is where the engineer and contractor can tap the benefits of Pratt's long experience . . . major features of Pratt Butterfly Valves include exactly those things that simplify difficult jobs: minimum head room, versatile operators that can be buried without vaults . . . and design and construction such that the valve will always be easy to open or close.

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Briefs

Sludge Gas Utilization at Aurora, Ill., is a good example of the best practices in the matter of using gas produced from sludge digestion. This article also presents a brief review of the history of sludge gas utilization as well as notes on volume and composition of gas, gas purification, hazards and safety practices and collection and storage of gas—page 499.

FSIWA Activities and Board Actions at the Detroit meeting are summarized in a short report—506.

How is Your Planning is another in a series of Dear Bill Letters, this one dealing with the development of 10 basic ideas for long range planning—page 508.

Chlorination of Wastewater is the second of a series of articles in a Chlorination Guide for water and sewage works operation. This second article is devoted to the use of chlorine in the treatment of sewage—page 509.

Administration, Cost Reductions and Syndets were among the several topics covered in papers presented at the Detroit meeting of the Federation. This report reviews the papers on these subjects—page 516.

Public Recognition for men working in water supply and sewage disposal were discussed at the Joint Meeting of the Ky.-Tenn. Sect. AWWA and the Ky.-Tenn. Sew. & Ind. Waste Assn. The report reviews the principal papers presented at that meeting—page 520.

Oil Filters on Sludge Gas Engines at Hunts Point Sewage Treatment Plant in New York Ctiy has proved useful to cut down the cost of operation of the dual fuel gas engines which are used for power generation at this plant. A new type of oil filter is described and the results obtained are set forth—page 522.

Future Water Demands must be considered in designing or redesigning water supply systems and among the features that must be taken into account are our changing way of life, decentralization of industry, and fire protection—page 525.

Sizing Water Service Piping has been standardized at Milwaukee. This article sets forth rather complete details on the present specifications of the Milwaukee Water Works—page 530.

Oxygen Solubility and Percent Saturation in Water can be easily calculated by the use of a special nomograph—page 537.

Polyphosphate Treatment in water conditioning is relatively in its infancy and this article traces the history of the treatment as well as presenting many of the present varied uses of hexametaphosphate—page 538.

Plastic Pipe for Water Distribution had some early failures but this article describes new types of materials and presents a selection guide for sound applications of this new material—page 541.

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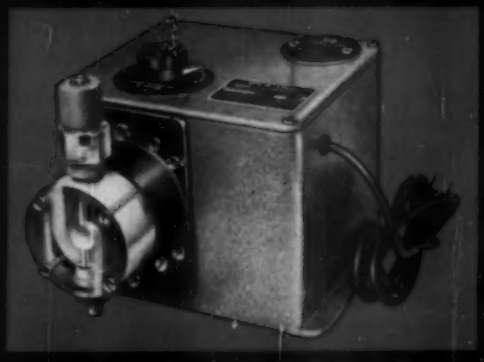

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News—Here & There

John H. Murdoch, Jr.

Consulting Engineer of Wynnewood, Pa. was relected President of the Pennsylvania Water Works Association at its annual meeting in Atlantic City in October. This year, a special program on water works management was featured at the meeting. Permission has been obtained from the Association to publish all of the papers as a symposium on water works management in WATER & SEWAGE WORKS early in the coming year.

Because of the interest of private water companies in other states surrounding Pennsylvania in the activities of the organization, the Association will consider revising its constitution next year to permit membership outside of the State of Pennsylvania. The organization is also making available an associate membership to individuals both within and without the State, whether or not they are employed by private water companies.

The So. Dakota Water & Sewage Conf.

held its 24th annual meeting at Deadwood in September. The program included two panel discussions; one on "Water and Sewage Problems in Recreational Areas," the other on "Public Relations Related to Water and Sewage Works." Other technical papers were presented on water and sewage problems in Wyoming, training and certification programs, and radiation and public health.

Officers elected for the ensuing year included: President, Alfred Ross, Huron; Vice Pres., Byron Fees, Chamberlain; Secy.-Treas., Don C. Kalda, Pierre. The Izaak Walton League Plaque was awarded to H. B. Dickerson, Supt. of Water & Sewage Works at Sisston, So. Dak. A tour of the Homestake Mining Co. concluded the meeting.

A Tribute

to the late L. L. Hedgepeth was received too late to be included in our November number, but because it expresses so well the sentiments of many of Hedgepeth's friends, we feel that it should be printed here. The author, Mr. Thomas M. Riddick, Consulting Engineer, of New York, wrote:

"On Sept. 3, about four o'clock in the morning, L. L. Hedgepeth, according to medical diagnosis, died of heart disease. As I write this statement, I become aware that it is such oversimplification that it smacks of half-truths and half-truths were no part of 'Hedge's' make-up. The situation can be more factually expressed by stating that the nature of his professional duties, which required extensive travel, plus his ever intense drive to obtain and present adequately the facts of each engineering situation with which he dealt, produced a weariness of the flesh which his vascular system could not long endure.

"The engineering profession has lost an eminently qualified technician and executive who was characterized by completely objective viewpoints. L. L. Hedgepeth wore no man's collar. His intellectual honesty compelled him to speak the truth as he saw it — regardless of whether or not it might mitigate against him, as it sometimes did. The humility and soul searching qualities of his character did not permit him to reach dogmatic conclusions, to which he was thereafter bound, or to reach those which smacked of political or partisan expediency. If his convictions were that available data were insufficient for the exercise of sound judgment, he did not hesitate to say so. And he did not hesitate to alter his expressed opinions if further facts showed previous judgment to have been premature. "Hedge," and the stabilizing aura of complete honesty and search for truth which surrounded him, will be sorely missed by friends and associates. His passing also deprives the new crop of budding engineers of one of the truly competent, honorable and great men of the engineering field."

Sheppard T. Powell

Consulting Engineer of 330 North Charles St., Baltimore, Md., has announced a change of the firm name to Sheppard T. Powell and Associates. Mr. Powell remains as senior partner; other partners include Hilary E. Bacon, Ph.D., Elmer L. Knoedler, M.E., Ph.D., and Lewis G. Von Lossberg.

A M Rawn

retired December 1 as Chief Engineer of the Los Angeles County Sanitation District. Mr. Rawn received Honorary membership in ASCE in October. At the present time he has no plans for the immediate future, but we expect him to do some writing for *Water & Sewage Works* in his capacity as Contributing Editor.

George F. Bernauer

Public Health Engineer in the central office of the Wisconsin State Board of Health was killed in a traffic accident early in October when his car collided with a County Highway Department dump truck.

Mr. Bernauer had been with the State Health Dept. since 1940 having been a District Sanitary Engineer until he was promoted to the central office in 1942. He served as Sewage Works Engineer, where his specialty was public sewage works assistance.

Mr. Bernauer was Chairman of the Sewage Works Standards Committee of the Great Lakes — Upper Mississippi River Board of Public Health Engineers. He had served as Secretary of the Central States Sewage & Industrial Wastes Division for several years and was a member of the Wisconsin Society of Professional Engineers; he was a Reserve Officer in the U. S. Public Health Service.

Water Works Month

was proclaimed for the month of November for the State of West Virginia by the Governor of that State. This action came in response to a request of Harry E. Jordan, Secy. of AWWA. The proclamation read:

"An abundance or pure water is one of the vital elements in the growth of our communities and in the development of our State.

"The American Water Works Association is to be commended for its program of Water Works Advancement. Its members can take pride in the fact that safe drinking water is

(CONTINUED ON PAGE 9A)

US RUBBER

USCOLITE PLASTIC PIPE

Mr. Usco reports:

After 5 years, all 8 miles of Uscolite still perform perfectly

The Omaha, Neb., Waterworks formerly used metal pipe to introduce strong chemicals into the water to purify it. But the corrosive fluids ate the metal pipe, requiring pipe replacement about twice a month. Then, "U. S." plastic engineers suggested sampling a piece of ½" Uscolite® plastic pipe.

"We were so pleased and amazed at Uscolite's performance," said a Waterworks executive, "that we quickly ordered it in various sizes for a total length of 43,000 feet. That was over 5 years ago, and today, the Uscolite pipe shows *absolutely no sign of deterioration*. The savings in money and maintenance are tremendous."

Uscolite is deliberately engineered to handle highly corrosive fluids. It is extremely light in weight, yet has high impact strength. It imparts neither taste, odor, nor discoloration. The Uscolite line of pipe, valves and fittings is the most comprehensive plastic pipe line in America and has been awarded the National Sanitation Foundation Seal of Approval.

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News—Here & There

CONTINUED FROM PAGE 7A

taken for granted in public water systems throughout our State and Nation.

"The growth of our communities requires constant attention to the continued supply of adequate and safe drinking water. As improvements and enlarged facilities are needed, water works projects must be carried out to maintain the health and welfare of our people.

"It is important that our citizens are always aware of the merits and needs of the public works system, for 'where water flows, cities grow.'

"Therefore, I, Cecil H. Underwood, Governor of the State of West Virginia, proclaim the month of November 1958, as *Water Works Month* in West Virginia, and urge water works operators to invite their consumers to visit and to learn about the operations of this vital industry. I further urge all citizens to acquaint themselves with the water works systems in their communities."

Pacific Northwest S & I W A

held its 25th annual meeting in late September at Spokane, Wash. Three of the original members, David B. Sharlton, Portland, Carl E. Green, Portland and Brian L. Shera, Tacoma, were present and recognized as 25 year men.

Elected to serve as officers for the ensuing year were: President, Marvin W. Runyan, Consulting Engineer, Stevens and Thompson, Portland, Ore.; Vice Pres., Robt. O. Sylvester, Prof. of San. Eng., Univ. of Wash., Seattle, and Secy.-Treas., Prof. Gilbert H. Dunstan, Prof. of San. Eng., State College of Washington, Pullman, Wash.; Director to FSIWA, R. Trumbull Smith.

Two panel sessions were presented; the first on "Problems of Sewer Rates, Rentals, and Pre-treatment," and the second on "Sewer Pipe Loading; Theory and Practice." One session was held for treatment plant operators. Papers included on the program were the "Role of Sewage Treatment Plants in the Community" by D. A. Huston; "Results and Progress of the Biosorption Process in Seattle" by Gene Davis; "A New and Promising Method for Removing Nutrients from Domestic Sewage" by J. C. Pluntze and R. H. Bogan.

Industrial Wastes came in for a share of the program with papers on vegetable wastes disposal, and two panel discussions on "Biological Aspects and Methods Used in the Control of Water Pollution," and "Outstanding Examples of Water Re-use in Industry."

The meeting concluded with two papers, one by H. E. Miller, director and Chief Engineer, Wash. Pollution Control Comm. on "Multiple Water Use and Water Quality Criteria"; the other paper was presented by Prof. R. O. Sylvester on "Some Influences of Multipurpose Water Usage on Water Quality."

The accompanying photograph shows both outgoing and incoming officers and charter members of the Pac. N.W. S&IWA. In the front row are G. H. Runstan, Secy., Brian L. Shera, charter member; C. S. Zickefoose; in the back row are M. W. Runyan, incoming President, A. J. Wahl, K. S. Watson (Pres. of FSIWA 1958), R. T. Smith, R. O. Sylvester incoming Vice Pres., C. E. Green, charter member, and H. L. Thompson, current FSIWA Director.

Clark, Daily and Dietz

Consulting Engineers, Champaign-Urbana, Ill. and Memphis, Tenn., has announced the addition of Dr. W. D. Painter as a partner in the firm. Dr. Painter has been an Associate in the firm since early in 1957; he will continue to manage the Memphis office of the company.

The partners also announce that the following men have been made Associates in the firm: H. W. Byers, P. W. Clinebell, B. C. Conklin, D. R. Smith, M. Fuat Tigrak, Jameson Vawter, A. G. Cox and D. J. Henry.

Dr. Marvin L. Granstrom

formerly an associate professor at the University of North Carolina, has been named Chairman of the Department of Civil Engineering in Rutgers University's College of Engineering in New Brunswick, N. J. He succeeds Dr. W. Brewster Snow, professor of civil engineering, who relinquished the administrative duties to devote his time fully to research and teaching civil and sanitary engineering.

C. C. Casad

Superintendent of Water Works, Bremerton, Wash., died in September. He had been Water Works Supt. since 1943, and had been Public Works Commissioner and City Engineer before that. Mr. Casad had been a member of AWWA since 1926; he received the Fuller Award in 1943 and served on the Board of Directors from 1953 to 1956 inclusive.

A Correction

has been suggested to page 413 of the October number of Water & Sewage Works. Mr. Joseph Woolf, Asst. Superintendent of Sewage Treatment at Coral Gables, Fla., writes: "In the article by E. J. Laubusch on 'Chlorination of Works' on page 413, the paragraph head 'Other Common Oxidizable Materials' contains the statement 'To remove one part of H_2S requires about 8.5 parts* of chlorine'; and the footnote reads, '*A part can be a mg/L (ppm) or lb/mil gal or any other value as long as one unit of measurement is used throughout the relation or calculation.'

"Unless one reads this footnote carefully, it might be misinterpreted to mean that a part per million is the same as a pound per million gallons, which, of course, is not true. It would be better if the author wrote 'To remove one part by weight of H_2S requires about 8.5 parts by weight of chlorine'; and then the footnote should read, 'A part by weight can be expressed as mg/L (ppm), lb/mil gal or in any other weight units as long as the same unit is used throughout the relation.'"

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- Double Drain Valves
- Bronze Seat Ring
- Resilient Balata Valve
- Double Drain Openings
- Bronze Cap Nut
- Positive Stop
- Pedestal Base Shoe

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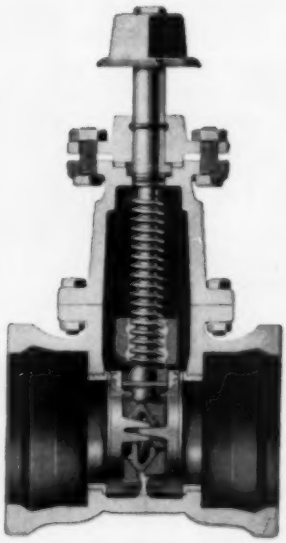

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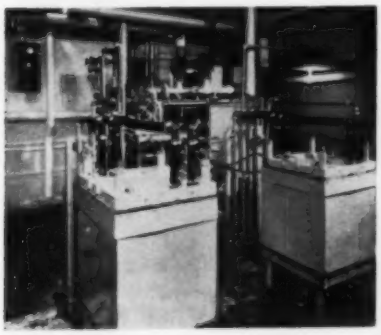
Equipment News

Water Desalter Serves New York Thruway Restaurant

1201

Ionics, Inc., Cambridge, Mass., has announced that the first commercial saline water conversion plant east of the Mississippi River has just started operation at a restaurant here on the New York State Thruway, near the Finger Lakes Region of Upper New York State.



The desalter will remove about 200 pounds of undesirable salts each day from 12,000 gallons of brackish well water to produce fresh, potable water for drinking, cooking and all restaurant operations, as well as for air conditioning and boiler makeup.

A 90-foot well drilled at the restaurant site produces highly mineralized water due to salt and gypsum deposits. The water (with approximately one-fourteenth the mineral content of full-strength sea water) was so unpalatable that it could not be used for drinking and cooking. For the past three years, the Thruway Authority has purchased bottled water for the restaurant, paying $1 for each 5-gallon bottle. The total restaurant water bill ran between $300 and $450 a month. The mineralized water also caused expensive corrosion of kitchen equipment, boilers and air conditioning equipment. The Ionics' unit, purchased for $42,500, is expected to produce water at an operating cost of about fifty cents per thousand gallons.

Antifoams

1202

Silicones Div., Union Carbide Corp., New York, N. Y., has developed "Sag" Antifoams, the new fast-acting and highly effective foam killers for industrial use.

The new products come in two forms—"Sag" 47 Silicone Antifoams Fluid for non-aqueous systems and "Sag" 470 Silicone Antifoam Emulsion for aqueous foaming systems. Handy eight-ounce samples in polyethylene squeeze bottles are being distributed to industries desiring to evaluate the newest, most effective of the silicone anti-foams.

"Sag" Antifoams have been developed in Union Carbide Corp. laboratories to fight foam fast. Only small quantities are required; often somewhere from 10 to 200 parts per million is all that is needed.

"Sag" 47 Silicone Antifoam Fluid is a 100% solids solution which can be used at full strength, or as a solvent

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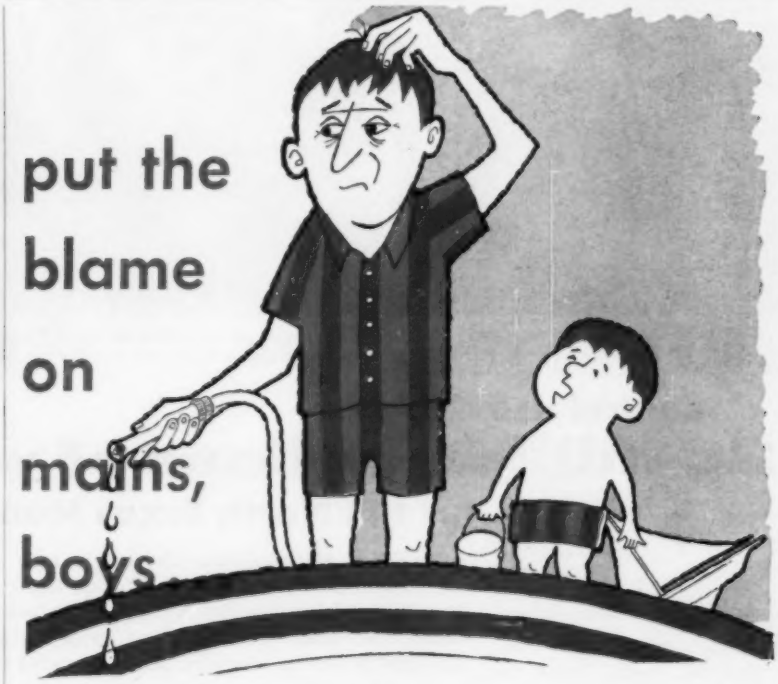


Did you hear a lot of customer complaints about low water pressure last summer? After the spring's heavy rains which filled reservoirs to the brim all over the country, *there should be no water shortage.* The problem probably rests underground . . . mains and distribution grids choked by pressure-killing tuberculation and corrosion.

There's one sure cure for your pressure problem . . . the Centriline Process. Centrilining permanently increases carrying capacities in all sizes of pipe by eliminating tuberculation and corrosion forever. After loose scale and tubercules are removed from the pipe, the Centriline machine applies a smooth, uniform coating of cement-mortar to the pipe wall by centrifugal force. Fast and economical, Centrilining is accomplished with a minimum of interruption to surfaco traffic, since the pipes are lined in place and excavations are not required at laterals and services.

With the introduction this year of the new, small diameter Centriline machine, you can permanently protect all water lines from 4 to 144 inches in diameter. Send today for our new brochure which fully describes the Centriline Process.

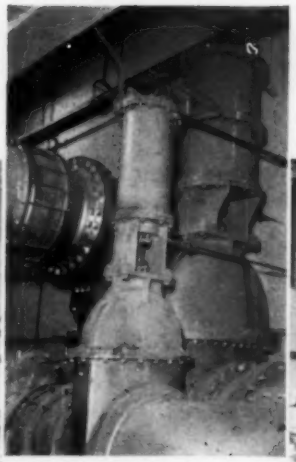
CENTRILINE CORPORATION

A Subsidiary of Raymond International Inc.

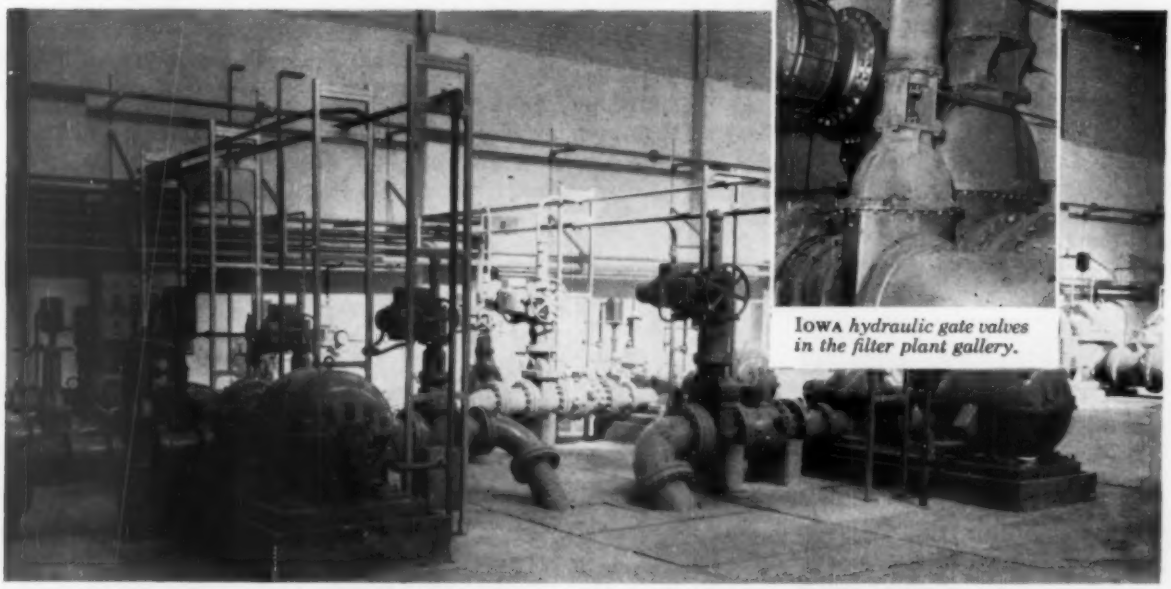
140 Cedar Street
New York 6, N. Y.
WOrth 2-1429

Branch Offices in Principal Cities of the United States, Canada and Latin America.

40 IOWA GATE VALVES...



IOWA *hydraulic gate valves in the filter plant gallery.*



IOWA *motor-operated gate valves installed in the main pump station of North Texas Municipal Water District. (General Manager: Mr. A. P. Rollins; Consulting Engineers: Forrest and Cotton; Design Engineer: Mr. Ormond A. Stone.)*

Control delivery of
20 million gallons of water a day
for the North Texas Municipal Water District

• Forty Iowa Hydraulic and Motor-operated Gate Valves—from 4" to 30" sizes—are used in the Filter Gallery and High Lift Pump Station of the North Texas Municipal Water District, supplying 10 North Texas Municipalities and the District's largest customer, the City of Dallas. Additional IOWA gate valves are used in the six pumping plants operated by the district.

The Filter Plant, located at Wylie, Texas, has a capacity of 20 million gallons a day. However, the design is such that it can operate safely at twice this amount. Water is delivered to the ten member municipalities and the City of Dallas through 90 miles of transmission line, ranging from 12 to 42 inches in diameter.

This Texas application is typical of the ability of IOWA to furnish gate valves to meet the most exacting specifications for plant and distribution service. Be sure and check the wide variety of IOWA valves, accessories and specialties before you place your order.

Let us send you details on Iowa's complete line of valves and hydrants

IOWA

VALVE COMPANY

A Subsidiary of James B. Clow & Sons, Inc.

Oskaloosa, Iowa

Equipment News

CONTINUED FROM PAGE 11A

solution, or blended with other materials. It is available in a one-pint, wide mouth jar containing one pound; in a one gallon open top can containing eight pounds, and in a five gallon open top can containing 40 pounds.

"Sag" 470 Silicone Antifoam Emulsion contains 10% silicone solids by weight, and is ready for use, but can be further diluted if desired. It comes in one gallon and five gallon cans and in drums of 55 gallons.

Plastic Packing For Biological Waste Treatment

1203

Dow Chemical Co., Midland, Mich., has developed a new approach to the biological treatment of liquid wastes in the form of a plastic packing material designed to improve the conditions under which micro-organisms oxidize wastes.

The products, trademarked Dowpac, has been field tested extensively in the treatment of domestic sewage and wastes from metallurgical coke, kraft paper, ragmill, chemical and petroleum plants.

Dowpac is made up of many layers of corrugated sheets of Stryon (Dow polystyrene) or saran, depending on the type of chemical resistance needed.

Advantages of the plastic packing, Dow says, lie in its unique shape, light weight, structural properties and versatility.

The corrugated shape, for example, provides large surface areas to which

CONTINUED ON PAGE 17A

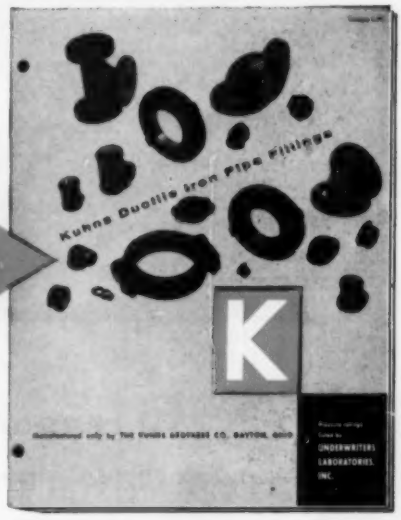
WHAT DO YOU WANT TO KNOW ABOUT KUHNS

DUCTILE IRON

PIPE FITTINGS?

THE ANSWERS ARE HERE

YOURS FOR THE ASKING!



Get complete data on—

- Types and sizes available
- Typical applications
- Safety factors and service ratings by Underwriters' Laboratories, Inc.
- Prices
- Physical properties; production control tests
- Specifications—A.M.S., A.S.T.M., Ordnance, Navy, Coast Guard, National Fire Protection Association, National Board of Fire Underwriters, Corps of Engineers
- Impact test data

DUCTILE IRON PIPE FITTINGS MANUFACTURED ONLY BY

THE KUHNS BROS. CO.
DAYTON, OHIO

THE KUHNS BROTHERS CO.
1800 McCall Street, Dayton, Ohio

Send me a free copy of Catalog 2-PF on ductile fittings.

NAME_____ TITLE_____

COMPANY_____

ADDRESS_____

ABILITY . . .

6 reasons why Cast Iron Pipe is #1 choice of U. S. A.

1. **HIGH FLOW CAPACITY . . .** Cement lined cast iron pipe and fittings will not tuberculate . . . delivers a full flow for the life of the pipe.
2. **LONG LIFE . . .** 42 North American cities are still using cast iron water mains laid 100 years and more ago. Hundreds more have passed the 50 year mark.
3. **BEAM STRENGTH . . .** Cast Iron Pipe is inherently tough . . . stands up under heavy traffic load, soil displacement and disturbance.
4. **EXTERNAL LOAD RESISTANCE . . .** 6" Class 150 Pipe withstands a crushing load of 17,900 pounds per foot . . . nearly 9 tons.
5. **CORROSION RESISTANCE . . .** Cast Iron Pipe effectively resists corrosion . . . vital factor in its long life and dependability.
6. **TIGHT JOINTS . . .** A full range of leak-proof, low cost, easy-to-assemble joints for pipe and fittings are available for all conditions.

THE MAN WHO CHOOSES CAST IRON PIPE TODAY WON'T PAY FOR IT AGAIN TOMORROW!

CAST IRON

Cast Iron Pipe Research Association
Thos. F. Wolfe, Managing Director
Suite 3440, Prudential Plaza, Chicago 1, Ill.

MODERNIZED **cast iron**

NOT PROBABILITY!

Cast Iron Pipe's record of maintaining high flow capacity throughout its long life is FACT not FICTION!

Carrying capacity without strength is like running a rickety car with a powerful engine . . . sooner or later it will shake apart.

Why choose between high flow, strength and long life when cast iron pipe gives you *all* of them?

Specify America's #1 pipe and your water system will serve long after the bond issue is retired.

*Here is the proof!

FLOW FACTORS FOR CEMENT LINED CAST IRON PIPE

LOCATION	SIZE	TEST SECT. IN FEET	VELOCITY F.P.S.	AGE YEARS	W & H "C" FACTOR
Bowling Green, Ohio	20"	45,592	0.7-2.4	New	142.5
Chicago, Illinois	36"	7,200	2.6-3.6	New	147
New Orleans, La.	12"	39,650	1.2-2.9	New	141
Corder, Mo.	8"	21,350	0.9-2.3	New	143
Univ. of Illinois	8"	400	3.14	New	150
Concord, New Hamp.	14"	500	1.7-2.2	New	151
Concord, New Hamp.	12"	500	2.0-3.4	11	142
West Palm Beach, Fla	12"	500	3.6-5.4	15	139.5
Greenville, S. C.	30"	87,376	2.4-2.7	12	148.5
Corpus Christi, Tex.	30"	65,641	1.1-1.8	6	146
Summerville, S. C.	8"	500	1.98-2.43	13	142.5
Champaign, Illinois	16"	3,920	3.1-5.6	22	139.3

*Available upon request: Booklet containing flow test and tables on Cast Iron Pipe.

pipe FOR MODERN WATER WORKS

improving a superior product

American Concrete Cylinder Pipe has long been established as one of the outstanding developments in the field of pressure transmission of water. This superior design combines the physical properties of steel with the structural and protective properties of concrete — producing a pipe of great strength and long life. Important transmission lines of American Concrete Cylinder Pipe are today serving most of the major cities and population centers in the western United States.

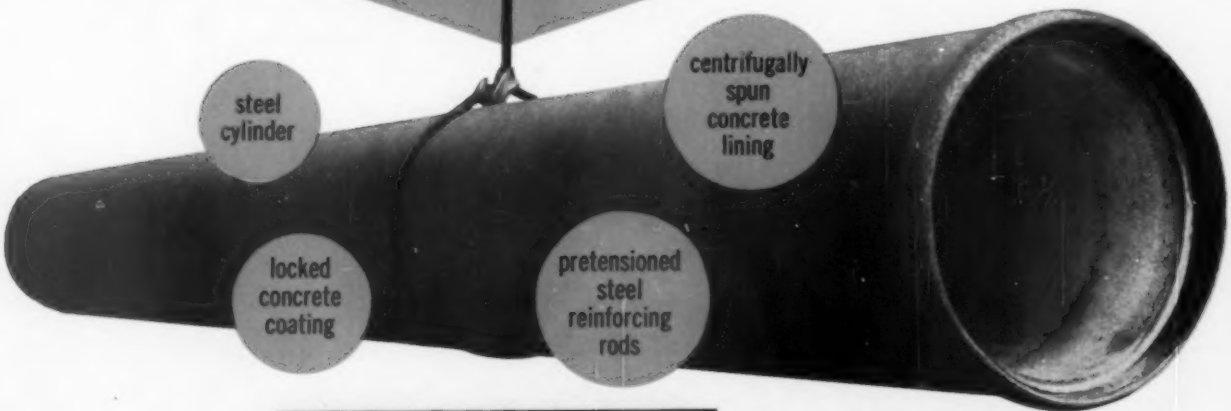
Through the years, continuing research has led to improved features in the manufacturing process. These features enrich the alkaline environment surrounding the steel components, which environment is so necessary to the continuing and everlasting protection that well-made concrete gives to this high quality pressure pipe.

Specify these plus-factors featured by American — where research, development and quality control are always striving to make high quality products even better.

American Concrete Cylinder Pipe is available in a diameter range of 12" through 60" I.D. and in standard lengths of 32 feet.

Rich cement wash applied to steel reinforcing rod just before it is wound under measured tension and with accurate spacing around concrete lined cylinder provides positive assurance of a highly alkaline environment between surfaces of cylinder and circumferential reinforcement.

An additional rich cement wash over the entire outer surface of the pretensioned steel cylinder before application of the pipe's dense mortar coating ensures maximum alkaline environment where it is most needed.



American PIPE AND CONSTRUCTION CO.

Los Angeles: 4635 Firestone Blvd., South Gate, Calif., LOrain 4-2511

Hayward: P.O. Box 630—JEfferson 7-2072

San Diego: P.O. Box 13—CYpress 6-6166

Phoenix: 2025 South 7th St.—ALpine 2-1413

Portland: 518 N.E. Columbia Blvd.—BUtler 5-2531

Equipment News

CONTINUED FROM PAGE 13A

waste-treating bacteria can adhere, and, in addition, permits large volume air flow through the packing to supply the bacteria with necessary oxygen. Waste flow rates in excess of 800 million gallons per acre per day have been applied to Dowpac with no evidence of restricted air circulation.

Dowpac, is assembled in self-supporting units and can be stacked as high as 42 feet with simple under drains. This requires a minimum of ground or floor area.

In addition to its use in oxidation towers, Dowpac can serve as an aeration device for activated sludge treatment systems.

"Progressing Cavity" Pumps

1204

Robbins & Myers Inc., Springfield, Ohio, has announced that broken glass, rages, and small stones were effectively handled for 19 months by their new "progressing cavity" pump installed at an Oakland, California sewage treatment plant. Centrifugal pumps used previously lost power and broke down as often as once a month trying to keep the thick sludge and suspended particles moving from sedimentation basins to digester tanks; pump slow-down also allowed grease to congeal in sludge lines, reducing flow and elevating pressures. "Progressing cavity" pump, known as the Moyno and similar in operation to a precision screw conveyor, forms pockets between rotor and stator that move continuously toward discharge end. Its positive pressure kept sludge lines clean, kept discharge rate at 80 to 160 gpm with rotor turning at 310 to 620 rpm by a 7½ hp motor.

New Mechanical Sludge Bed Cleaner

1205

Link-Belt Co., Chicago, Ill., has developed a one-man operated mechanical sludge bed cleaner with a capacity up to 3,100 sq ft of sludge bed per hour. The company claims it permits savings of 60 per cent annually over manual cleaning methods.

Described as a conveying system on wheels, the new Link-Belt sludge bed cleaner couples to a standard tractor for motive power. It consists of two hydraulically operated forked scoops, which, when raised, empty into wing conveyors directly behind the scoops. These conveyors feed into a center longitudinal flight conveyor at a 45 degree incline. It discharges the sludge into a truck.

Advantages of the new mechanical sludge bed cleaner are given as: more economical and faster removal of sludge with minimum loss of filter bed sand; re-levelling of sand as cleaner is backed off of bed; easy coupling and uncoupling of unit to standard tractor; convenient one-man control of complete cleaning cycle.

Aerator Offers Optimum Oxygen Absorption Efficiencies

1206

Dorr-Oliver Inc., Stamford, Conn., has announced the availability of the

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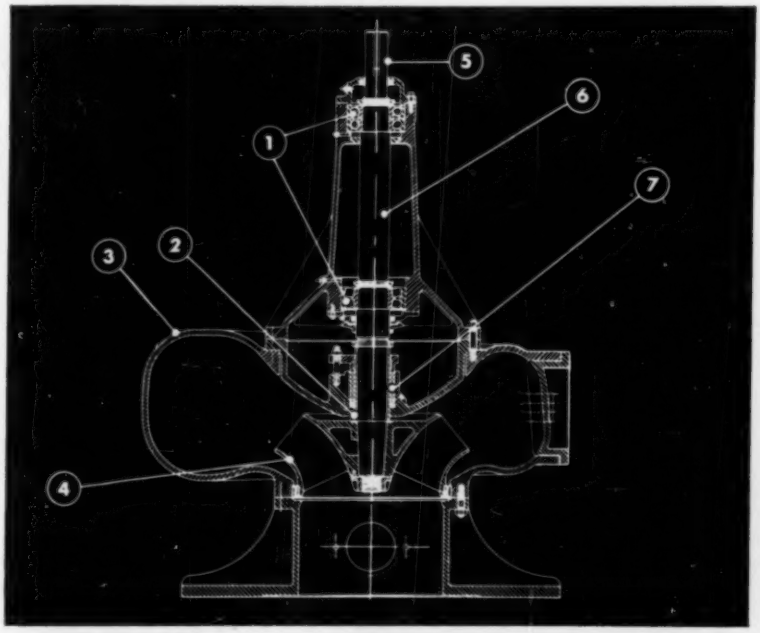


Which features are biggest down-time savers in big sewage pumping jobs?

Wheeler-Economy says these features of its Mixed Flow Volute Pumps will be on anyone's list. See if you don't agree.

1. BALL AND ROLLER BEARINGS with heavy-duty thrust bearing located atop bearing bracket.

2. EASILY-ACCESSIBLE ROTOR reduces down-time for maintenance.

3. HIGH-STRENGTH CASING is close-grained cast iron. Steel or special alloys furnished to meet special conditions.

4. IMPELLER is bronze, cast iron or alloy suitable for the service. Wearing Rings are easily renewable.

5. FLEXIBLE COUPLING is located between the Pump and the Motor.

6. HEAT-TREATED ALLOY STEEL SHAFT is extra large for added strength and is precision ground and polished.

7. STUFFING BOX is unusually deep to hold adequate packing and is easily accessible for replacing packing. It can be fitted with cage or lantern ring for flushing when pumping gritty liquids.

8. VERTICAL OR HORIZONTAL mounting can be furnished.

Write for Catalog F-102, for complete information on sewage pumps with 3000-150,000 gpm. capacities

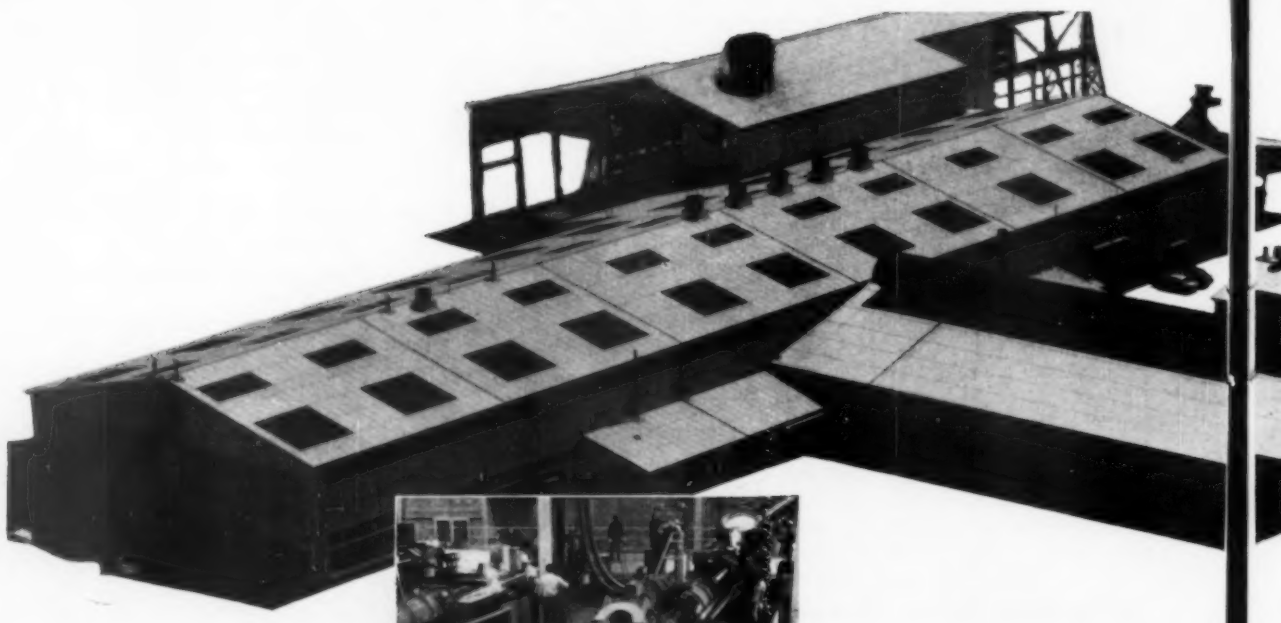
Economy Pump Division

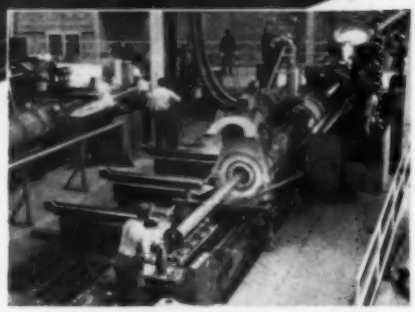
C. H. WHEELER MFG. CO.

19th and Lehigh Avenue • Philadelphia 32, Pa.

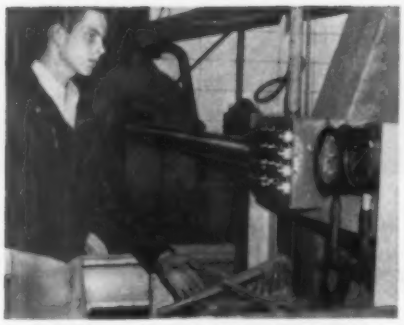
Whenever you see the name C. H. Wheeler on a product, you know it's a quality product

Centrifugal, Axial and Mixed Flow Pumps • Steam Condensers • Steam Jet Vacuum Equipment • Marine Auxiliary Machinery • Nuclear Components





Using the metal mold process, the new casting machines at Bensenville include many patented improvements which are unique with Clow.

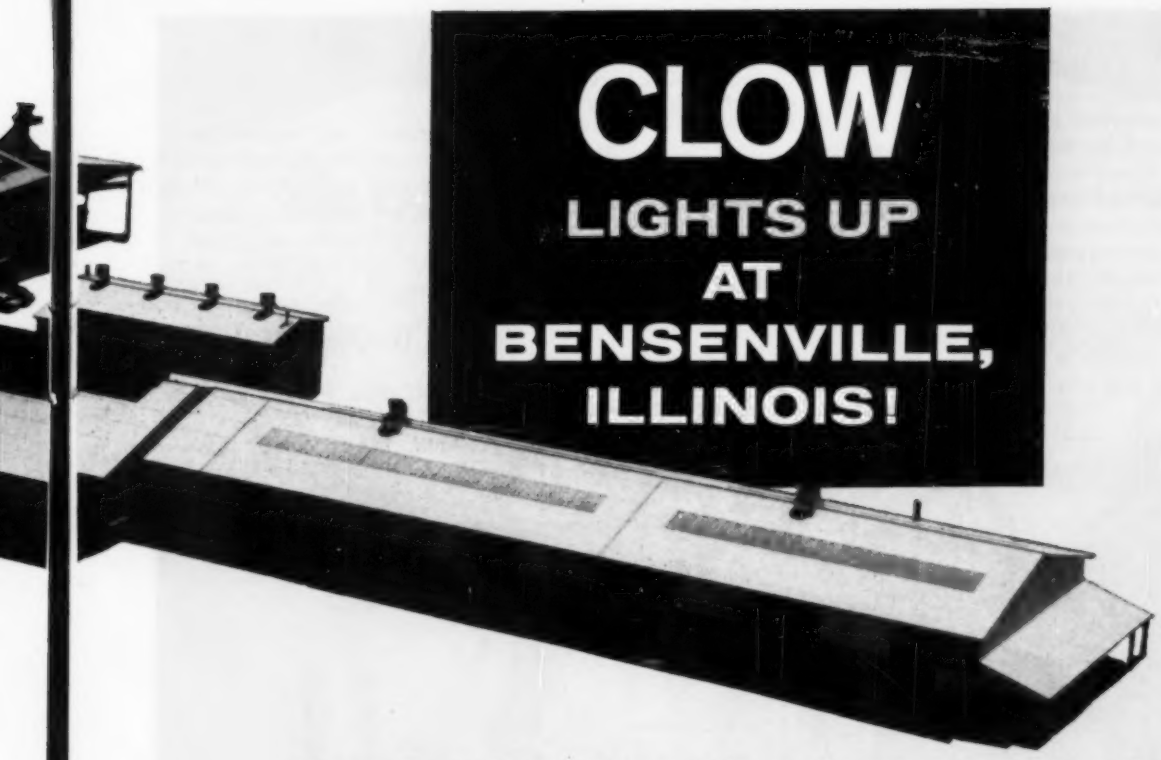


Testing is a continuous phase of the manufacturing process. All Clow pipe is subjected to a hydrostatic test of 500 lbs. per sq. inch of water pressure—2 to 4 times the normal working pressure.

CONTROL... The Key to Clow's High Quality

Clow cast iron pipe quality is assured by automatic instrument control during manufacture. In some cases, these control systems were developed exclusively for Clow.

Pipe annealing, a vital step in making Clow cast iron pipe, is carried out in this annealing oven —the most modern of its kind.



New Cast Iron Pipe Plant Begins Production to Meet Growing Midwest Market Demands

On September 22, 1958, the first pipe was poured at the new Bensenville, Illinois, Works of JAMES B. CLOW & SONS, INC., starting production at the most modern cast iron pipe plant in the world. The first plant ever constructed in the central states area for making cast iron pipe, Bensenville is located in suburban Chicago and is ideally situated to meet present and future demands for Clow pipe. By bringing producer and users hundreds of miles closer together, this new manufacturing plant will be able to deliver dependable Clow cast iron pipe *faster* for all construction needs. Bensenville is strategically located for shipment by rail, or by truck over the modern new highway network of the Chicago area. In addition, customers will benefit from new efficiencies of modern mass production in a plant located in an area central to vital raw materials for making cast iron pipe.

The inauguration of pipe production at Bensenville marks another step in Clow's continuing expansion program. Clow now operates pipe plants at Coshocton, Ohio, and Birmingham, Alabama, in addition to Bensenville. Bensenville is another major Clow investment in better products to better serve its customers.

OUR 80th YEAR • 1878 TO 1958

CLOW CAST IRON PIPE

JAMES B. CLOW & SONS, INC.

201-299 North Talman Avenue, Chicago 80, Illinois

Equipment News

CONTINUED FROM PAGE 17A

D-O Aerator, a new unit for supplying oxygen demands in the activated sludge process. Combining carefully controlled mechanical fluid mixing with high oxygen absorption efficiencies, this aerator attains effective oxygen absorption ranging from 5 to 50 per cent depending upon the specific application. As a result, shorter aeration periods are possible in both presently overloaded and new treatment plants.

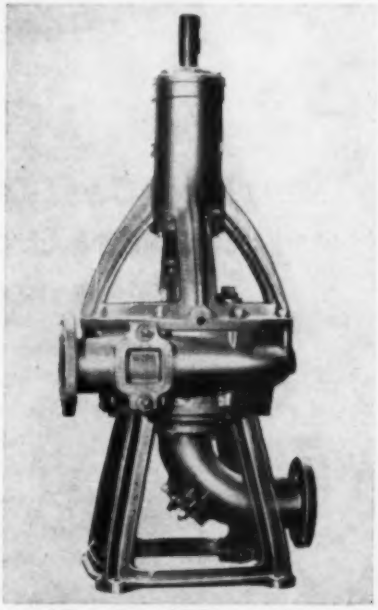
The D-O Aerator comprises a standard type mixer drive powered by a direct connected electric motor, driveshaft, turbines and sparge ring. The complete assembly is mounted on a beam structure spanning either a rectangular or circular tank. Mixing is accomplished by turbine-type impellers attached to the vertical drive shaft which is suspended from the mixer drive and connected to a steady bearing on the tank floor. A circular perforated pipe sparge ring through which air is introduced is mounted near the floor of the tank beneath the impellers.

In operation, air supplied by a blower is admitted to the tank through the sparge ring perforations. Rising air bubbles are thoroughly dispersed and oxygen is absorbed as a result of the mixing, shearing action of the revolving impellers.

Vertical Torque-Flow Pumps

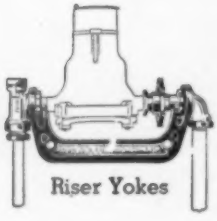
1207

Wemco-Torque Flow Pump Div., Western Machinery Co., San Francisco, Calif., has announced that two new Wemco Torque-Flow Pumps, are now available for the first time in a vertical as well as a horizontal model. In addition to being available in vertical models, the new pumps—designated Type D and DL—are also available with a variety of drives. These drive options include: belt, close coupled, pedestal mounted, and extended shaft.



The Type D is available in both 4" and 6" sizes suitable for general duty pumping of solids even at high heads and high capacities. The model DL is a smaller version of the same pump, available only in the 4" size, usually used on low head application. Both new pumps have retained the design characteristics of earlier Torque Flow Pumps. It is this radical design, featuring a recessed impeller, that makes the pump non-clogging and highly resistant to abrasion.

An Ostrich is an
EXPENSIVE METER MAN



Riser Yokes

Angle Yokes

Straight Line Yokes

And so is anyone else who must stand on his head to set or change a meter. Old fashioned, hard-to-get-at connections, outdoors or in the basement, are time consuming and costly. Not only is the meter hard to change, but periodic efficiency checks are neglected and water revenues are lost due to inaccurate meters.

Be sure your system is modern. See that Ford Meter-setting Yokes are keeping every meter available for quick changing and testing. Savings in time, and increased water revenues are often enormous.

You can change a meter in a Ford Yoke
EASILY

There are models for every condition. Send for free catalog.

FORD
FOR BETTER WATER SERVICES
THE FORD METER BOX COMPANY, INC. Wabash, Indiana

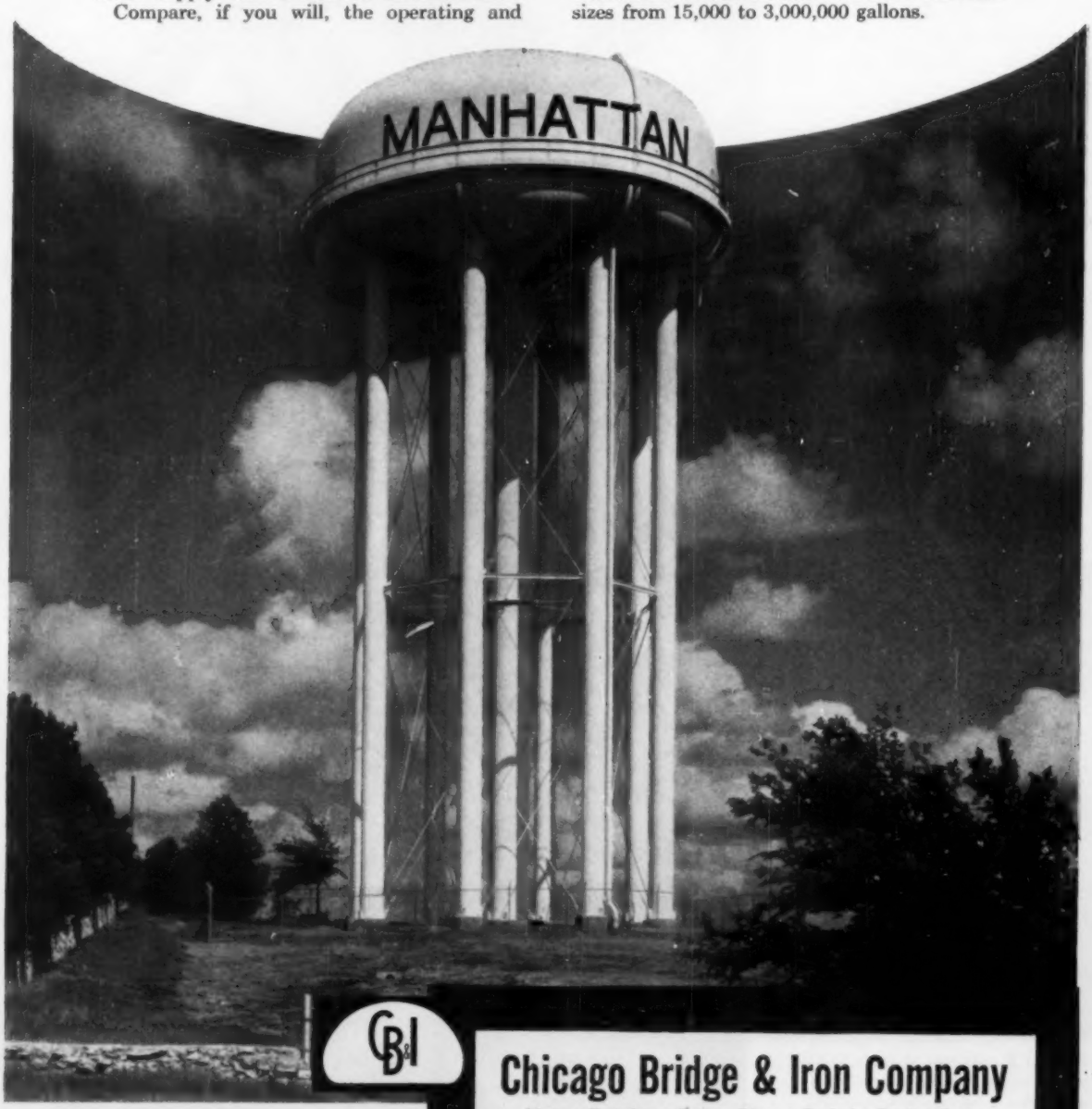
INCREASE WATER PRESSURE

MINIMIZE PRESSURE VARIATIONS

LOWER PUMPING COSTS • MAINTAIN DEPENDABLE RESERVES

These are the primary benefits which any community can realize with a water distribution system which incorporates gravity pressure water supply with a Horton® elevated tank.

Compare, if you will, the operating and maintenance costs to your community to realize these benefits by *any other* combination of equipment. Write our nearest office for information on Horton elevated tanks in standard sizes from 15,000 to 3,000,000 gallons.



• This 500,000-gallon Horton® Radial Cone elevated tank and a 1,250,000-gallon ornamented standpipe were fabricated and erected by CB&I for the City of Manhattan, Kansas.

M43C

CB&I

Chicago Bridge & Iron Company

Atlanta • Birmingham • Boston • Chicago • Cleveland • Detroit • Houston
Los Angeles • New York • Philadelphia • Pittsburgh • Salt Lake City
San Francisco • Seattle • Tulsa • Washington
Plants in BIRMINGHAM, CHICAGO, SALT LAKE CITY and GREENVILLE, PA.

View from pump floor in Oswego, New York, pumping station showing one of main pumps being driven by Westinghouse 300-hp vertical synchronous motor above.

Robert B. Stannard, Resident Engineer for Nussbaumer, Clarke and Velzy, Consulting Engineers; Karr Parker, Jr., Buffalo Electric Co.; Kenneth D. Jensen, Superintendent, Department of Water, Oswego; and M. B. Trimble, Westinghouse Construction Sales Engineer, discuss "tilt-out, lock-out" feature of the control center. Westinghouse double-ended control power center has 300-kva Inerteen® transformer at each end.

Oswego water pumping station Powers-Up to attract new industries

The modernization and expansion program of the Department of Water, Oswego, N. Y., provides an interesting example of building today for tomorrow's needs. While planning for today, Oswego's Water Board recognized that a good water supply is an indispensable commodity in attracting new industry to the area. By Powering-Up electrically, their new pumping station has electrical capacity five times present demand to allow for future growth.

Present demands for water are approximately 10 million gallons per day. Installed pumping capacity is capable of providing more than 20 million gallons per day. In addition, provision has been made to increase capacity to 35 million gallons per day when required by future demands.

The new pumping station is supplied with lake water from an intake tunnel which extends through solid rock for a distance of 6250 feet into Lake Ontario. This tunnel intake averages eight feet in diameter and is capable of conveying 128 million gallons of water per day.

Electrical power for the station is available from two separate sources—one direct from the Oswego Steam Station and the other from the Niagara-Mohawk Varick Station. The complete electric distribution system, as furnished by Westinghouse, provides for all anticipated future expansion of the pumping station.

Powering-Up electrically for future growth can offer important advantages to you. For further information, call the Westinghouse electrical engineer nearest you, or write Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania.

J-94119

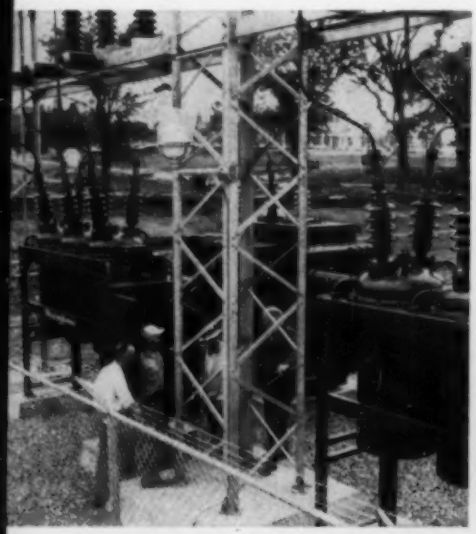
Owner: Department of Water, Oswego, N. Y.
Consulting Engineers:
Nussbaumer, Clarke and Velzy
General Contractor: McElwee-Courbis Const. Co.
Electrical Subcontractor: Snyder and Mackin, Inc.
Westinghouse Distributor: Buffalo Electric Co., Inc.

YOU CAN BE SURE...IF IT'S

Westinghouse

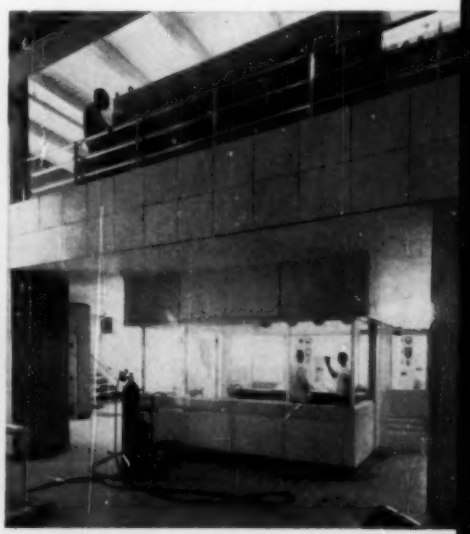
WATCH "WESTINGHOUSE LUCILLE BALL-DESI ARNAZ SHOWS"
CBS TV MONDAYS

Over 250 Pages Westinghouse Data in Sweet's Construction File.



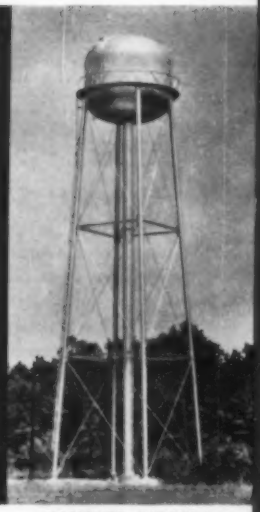
Leo J. Landrigan, Superintendent, Oswego Pumping Station; Richard C. Mansfield, Foreman for Snyder and Mackin, Electrical Contractors; Kenneth D. Jensen; and Charles T. Hansen, Westinghouse Sales Engineer, at outdoor substation which serves new Oswego pumping facility. Two Westinghouse 2000-kva power transformers and two Westinghouse 34.5-kv oil circuit breakers are included in this substation.

Main floor view in pumping station shows four Westinghouse vertical synchronous pump motors with the glass enclosed control room in background. The mezzanine floor above is occupied by Westinghouse 2300-v, heavy-duty, metal-clad switchgear, using Type DH air circuit breakers.



Another view of main floor shows reverse side of control room and, on the mezzanine, Westinghouse double-ended control power center. Floor openings in foreground, not shown, have been provided for the installation of four additional raw water pumping units when filter plant is added.

BEAVER, IOWA
25,000 gallons



HANOVER, VIRGINIA
60,000 gallons

PDM
ELEVATED STEEL TANKS

BETTER ELEVATED WATER STORAGE

comes in all sizes to serve every need

Pittsburgh-Des Moines' resources as pioneer builders of steel elevated tanks include every type of structure, in every capacity to meet your individual water storage needs—fabricated and erected with expert craftsmanship and a responsible guarantee of satisfaction.
Write for our latest "Modern Water Storage" brochure: 20 pages of interest and information!

FOREST, MISSISSIPPI. 500,000 gallons

PUEBLO, COLORADO. 1,500,000 gallons

Pittsburgh-Des Moines Steel Company

Plants at PITTSBURGH, BALTIMORE, DES MOINES, SANTA CLARA, FRESNO, and STOCKTON, CALIF.

Sales Offices at:

PITTSBURGH (25).....3418 Neville Island
BALTIMORE (26).....Curtis Bay Station
NEWARK (2).....1718 Military Park Bldg.
CHICAGO (3).....622 First Nat'l Bank Bldg.
EL MONTE, CAL.....P.O. Box 2012
ATLANTA (5)..361 E. Paces Ferry Rd., N.E.
DES MOINES (8).....919 Tuttle Street
DALLAS (1).....1223 Praetorian Bldg.
SEATTLE (1).....Suite 326, 500 Wall St.
SANTA CLARA, CAL.....625 Alviso Road
DENVER (2).....323 Railway Exchange Bldg.

New Bulletins *AVAILABLE FREE*

Digester Gas Metering

1208

B-I-F Industries Inc., Providence, R. I., has published a 4-page, 2-color bulletin titled "Ten Reasons Why Your Digester Gas Meter Should be a Shuntflo Meter." The bulletin explains how the Shuntflo is the lowest cost gas meter for flows above 2,000 cu ft hour, needs no daily draining, fits right into and is supported by the line, has low pressure drop, is corrosion-resistant and is completely self-contained and self-operated. Listing additional features, this new bulletin contains two installation testimonials, application photos, engineering data, cut-away views, specifications and how-to-order information.

Surface Wash Water Valves

1209

Golden Anderson Valve Specialty Co., Pittsburgh, Pa., has just published a new 4 page technical bulletin describing Surface Wash Water Valves for Filters.

According to the bulletin, these G-A control valves are used for surface wash water applications on filters and also for controlling the flow of water to the filters. They are easily opened or closed from the operating table in the usual manner.

Operating layouts, operation, construction and dimensions are included, along with complete specifications.

Rotameters For Flow Measurement

1210

Schutte and Koerting Co., Cornwells Heights, Pa., has just released a bulletin describing the company's line of Laboratory Rotameters for measuring fluid rate of flow. Flexible connections are provided on these Rotameters for quick, easy installation in plastic, glass, or metal piping from ¼ inch through 2 inch sizes.

The bulletin describes how the Rotameters are applicable to both liquids and gases. Two types of meter tubes are described: a high capacity fluted tube and a conical tapered tube. Standard floats are stainless steel type 316, but floats are available of other materials as required. The available capacities range from a few cubic centimeters per minute to 90 gallons per minute.

The Bulletin includes a sectional assembly drawing, and complete dimensional capacity, and sizing data.

Sludge Aerator

1211

Dorr-Oliver Inc., Stamford, Conn., has just published a new, four page, two color bulletin on the D-O Aerator. This bulletin describes the development, design and advantages of this improved method for supplying oxygen demands in the activated sludge process. Also included in the bulletin are cutaway wash drawings of typical aerator installations and an activated sludge flowsheet showing how the unit is employed.

According to the bulletin, the aerator is designed to provide maximum biological use of oxygen supplied in sewage aeration, and comprises a

CONTINUED ON PAGE 100A

The Birth of HYDRAULICS

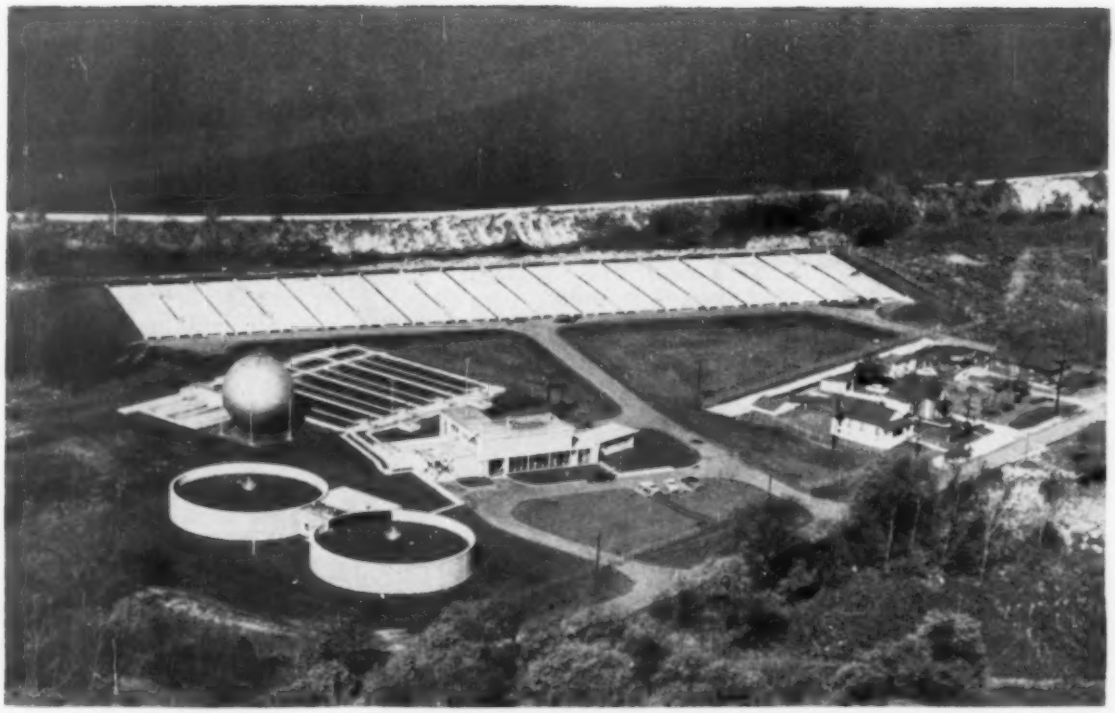
"Eureka!" (I have found it) cried the famous Greek sage Archimedes in the 3rd century B. C., as he discovered the principle of water displacement. But not until the 16th Century, A. D., many hundreds of years later, was the science of hydraulics really created when the French built the famous Fountains of Versailles near Paris.

Because water supplies are vital to life, ancient villages and camps had to be located near lakes or streams. Today, our modern civilization could not exist without the science of hydraulics which makes it possible to convey potable water in large quantities to distant centers of population. Instead of people going to the water, we now take the water to the people.

To a large extent, the men who manage and supervise our modern water distribution systems are unsung heroes. Like the stars in the sky or the cream in your coffee, they are "taken for granted." We believe that they deserve greater public recognition of their service.

This Series is an attempt to put into words some appreciation of the water works men of the United States.

M&H VALVE AND FITTINGS COMPANY
ANNISTON, ALABAMA
SUBSIDIARY OF WALWORTH



Joliet's new sewage treatment plant will help to restore the cleanliness and utility of the Des Plaines River and to serve as an example to the cities and industries who are still contributing to the river's pollution. Consoer, Townsend and Associates, Consulting Engineers, Chicago.

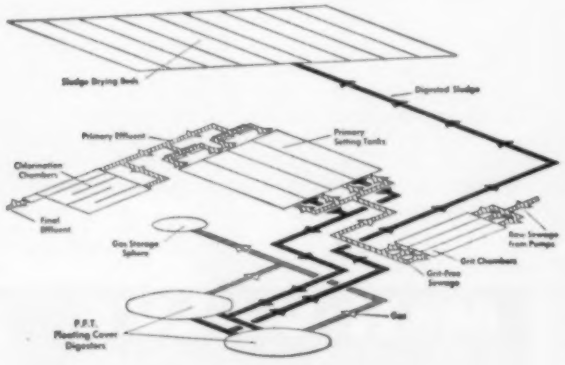
New plant at Joliet, Illinois employs P.F.T. "Controlled Digestion"

Designed to accommodate a population increase of more than ⅓, the sewage treatment plant at Joliet will be "new" for years to come. This progressive city is located on the Illinois Deep Waterway and has a present population of some 60,000.

The P.F.T. "Controlled Digestion" system incorporated into this plant includes: two P.F.T. 85′ Floating Covers, two of P.F.T.'s #750 Sludge Gas Fired Heaters, two Floating Cover Position Indicators, Gas Safety Equipment and two P.F.T. #450 Shell and Tube Heat Exchangers.

Here is a flow diagram of this new plant. It is designed to effectively treat an average flow of 15 million gallons per day expected from the future population of 82,900.

No wonder Joliet is proud of this modern plant. Information on any of the P.F.T. equipment used in this installation will be sent upon request.



Flow Diagram of Joliet Plant.

waste treatment equipment exclusively since 1893

P.F.T.

PACIFIC FLUSH TANK CO.
4241 Ravenswood Avenue
Chicago 13, Illinois

PORT CHESTER, N. Y. • SAN MATEO, CALIF. • CHARLOTTE, N. C. • JACKSONVILLE • DENVER

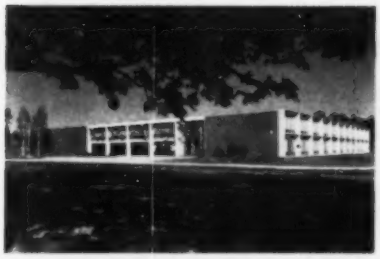
News of Suppliers

Dorr-Oliver Opens New Plant

Dorr-Oliver, Inc., Stamford, Conn., recently opened their new 120,000 square foot air-conditioned office in South Stamford.

The new building, designed to be in harmony with the immediately surrounding residential areas, is built in the shape of a hollow square with the front of the square opening into the full width of the center garden court. The entire side walls facing north and south are window walls, as all those facing the court. These areas house the executive and engineering offices. The service cores of the building are located along the solid east and west walls.

Built of reinforced concrete, the entire building is air conditioned throughout. The 400 ton capacity plant feeds both filtered cool or heated air through main ducts.



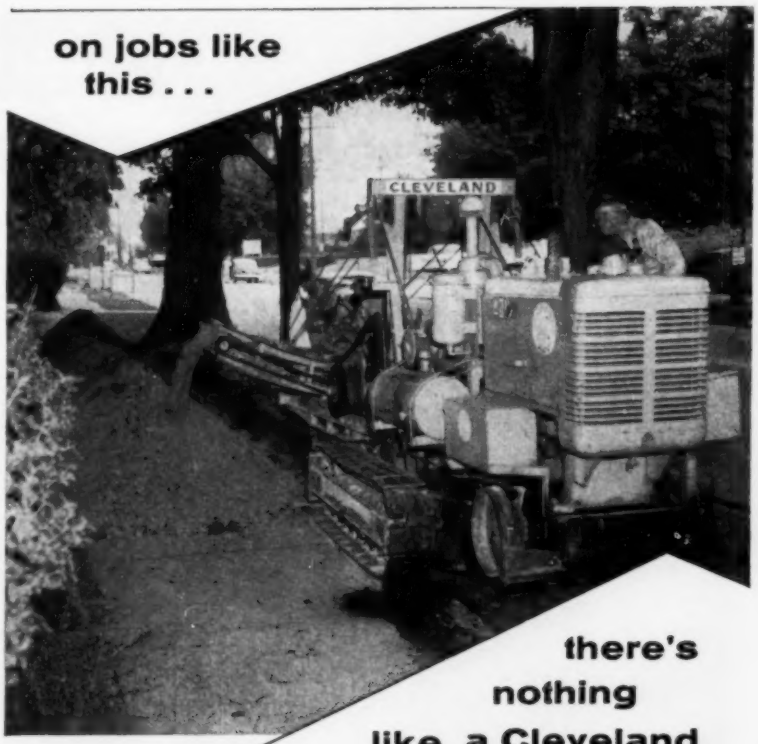
Serving as headquarters for the company, the new building houses all top level administrative, financial and sales operations. The majority of the company's technical divisions will also headquarter in the new building.

International Minerals Opens New Center

International Minerals & Chemical Corp., Skokie, Ill., has officially opened its new $5 million Administrative and Research Center in suburban Skokie.

The Center, which comprises five buildings just completed and a Research Center built on the 21 acre site in 1951, was designed by Perkins & Will, Chicago. It is described as a new and unique concept in business

CONTINUED ON PAGE 29A



TIGHT QUARTERS, narrow tree lawns, digging lines crowded with trees, utility poles, tough roots, intersecting service lines—nothing digs trench like a Cleveland "Baby Digger" in conditions like these.

PRECISION TRENCHING is needed here—a digging job on which a "Baby Digger" has no equal. Note how precisely this Cleveland 92 is placing spoil on sidewalk—off the well-kept lawn. Backfilling will be fast, easy and damage-free. Cleveland's low ground bearing pressure and smooth, friction-free crawlers are also big advantages on jobs like this.

ONLY 4'6" WIDE over its crawlers, the maneuverable 92 digs easily past obstructions, maintains steady, high trench production. More than 30 usable wheel and crawler speed combinations give it the right combination of power and speed for digging all soils—in mud, frost, tree roots, shale or rocky ground.

If city trenching is your job, there's nothing like a "Baby Digger" for you.

The CLEVELAND TRENCHER Co.

20100 ST. CLAIR AVE. • CLEVELAND 17, OHIO

Good Everywhere ®

In KNOXVILLE, TENNESSEE ✻

TYLOX Rubber GASKETS, REXON Rubber GASKETS, and REXON PIPE COATING

PREVENT JOINT LEAKS, WHIP ACID ATTACK AND SPEED PIPE LAYING ON STORM-SANITARY SEWER PROJECT

Engineers and city officials went "Hamilton Kent" all the way, in the matter of selecting *leak-proof* pipe joints and *acid-resistant* pipe coating to protect Knoxville's new Riverfront-Willow Avenue sewerage and drainage project . . .

Heavy duty precision TYLOX Gaskets coupled the large diameter T & G concrete storm lines. REXON "K" Light Duty Gaskets jointed the smaller diameter B & S sewer lines, and tough, non-deteriorating REXON No. 2 Pipe Coating put a protective covering inside all lines that would serve nearby stockyards, butchering plants and other industrial installations.

In specifying Hamilton Kent TYLOX and REXON *rubber* Gaskets, and REXON Pipe Coating, engineers and city officials not only provided to the utmost for the safety and long life of the system, but made possible substantial savings in construction costs . . . Both TYLOX and REXON Gaskets are quickly assembled to pipe, and permit fast assembly of the line. Their flexible, *compression* seal compensates for pipe angularities, allows wet trench coupling, and immediate backfilling.

✻ **PROJECT:** For City of Knoxville, Tenn., Riverfront-Willow Ave. storm and sanitary sewers.

ENGINEERS: H. R. Neal, City Engineer, and Roy I. Gentry, Service Director.

CONTRACTORS: Division A—Harrison Construction Company, Alcoa, Tenn. Division B—Blont Brothers Construction Company, Montgomery, Ala.

PIPE: T & G and B & S Concrete Pipe, manufactured by Sherman Concrete Pipe Company, Knoxville, Tenn.

5089

• **WRITE FOR BROCHURES** describing and illustrating use of Hamilton Kent TYLOX and REXON Gaskets and REXON Pipe Coating. Specify these products to protect your pipe projects from leakage and acid attack.

HAMILTON KENT MANUFACTURING COMPANY
KENT, OHIO
427 West Grant Street Orchard 3-9555

News of Suppliers

CONTINUED FROM PAGE 27A

environment. Turner Construction Company was the general contractor.

New structures include a five-story Administration Building, a three-story building housing the staff and operating divisions, a one-story electronic center, a one-story employee's lounge, and a one-story cafeteria building.

The central five-story Administration unit is the first office building in the country with its own heliport incorporated in the original design.

K & M To Erect New Facilities

Keasbey & Mattison Co., Ambler, Pa., has announced that work has begun on its major building program in Ambler which will provide a new office building as well as a modern research and development center, all scheduled for completion in mid-summer, 1959.

Completely air-conditioned, the new office building will house K & M's executive, financial, purchasing and statistical activities in two floors comprising 20,000 ft.

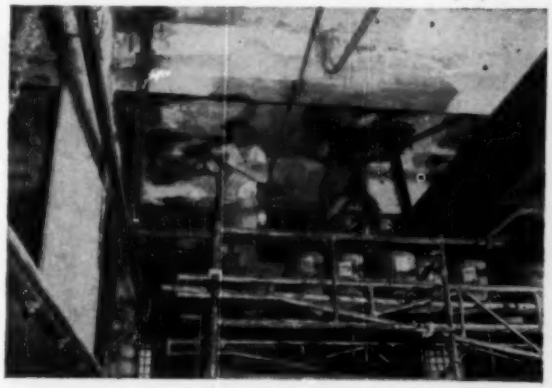
Robert R. Porter, K & M president, revealed that the new R & D Center will be one of the most modern facilities of its kind in the industry, boasting such refinements as a thermal conductivity room; an artificial climate room for simulating a wide variety of climatic and weather conditions, as well as separate laboratories for individual product research.

I'm taking a correspondence course in water main trench excavating.

How THORITE and THOROSEAL made this underground structure sound again!

Workmen prepare old surface for patching with THORITE.

Water has entered the concrete and caused corrosion of reinforcing rods, blistering the concrete off surface and causing structural weakness throughout building.

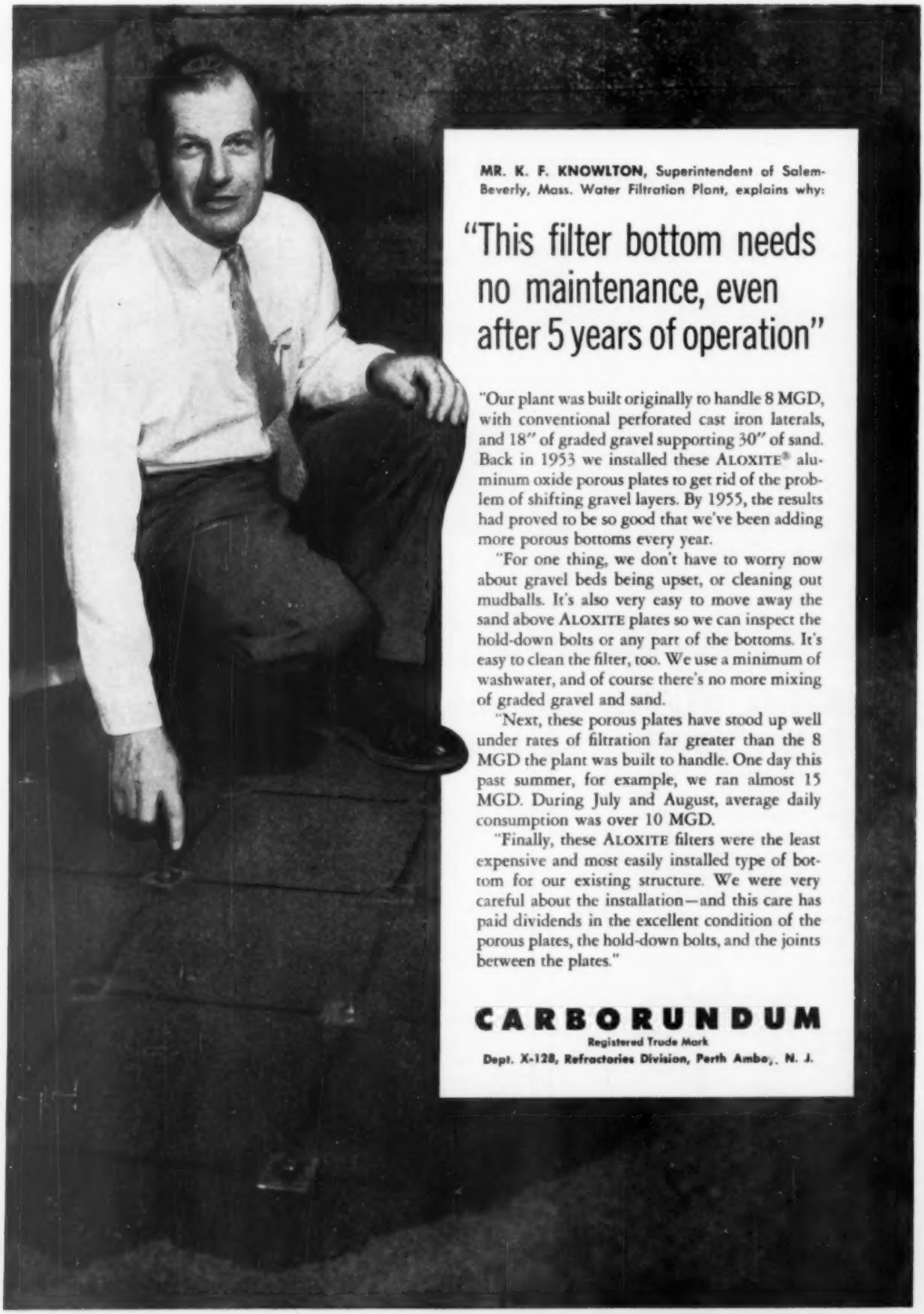


Reinforcing was cleaned, all corrosion was removed and brush coat of THORITE applied over entire patching area, then filled in with trowel coats of THORITE, even with surrounding surfaces.

THORITE Patching Mortar sets in 20 to 30 minutes and can be coated with THOROSEAL while hardening.

"How to do it" GET OUR 16 PAGE BROCHURE

STANDARD DRY WALL PRODUCTS, INC.
NEW EAGLE, PENNA. CENTERVILLE, IND.



MR. K. F. KNOWLTON, Superintendent of Salem-Beverly, Mass. Water Filtration Plant, explains why:

"This filter bottom needs no maintenance, even after 5 years of operation"

"Our plant was built originally to handle 8 MGD, with conventional perforated cast iron laterals, and 18" of graded gravel supporting 30" of sand. Back in 1953 we installed these ALOXITE® aluminum oxide porous plates to get rid of the problem of shifting gravel layers. By 1955, the results had proved to be so good that we've been adding more porous bottoms every year.

"For one thing, we don't have to worry now about gravel beds being upset, or cleaning out mudballs. It's also very easy to move away the sand above ALOXITE plates so we can inspect the hold-down bolts or any part of the bottoms. It's easy to clean the filter, too. We use a minimum of washwater, and of course there's no more mixing of graded gravel and sand.

"Next, these porous plates have stood up well under rates of filtration far greater than the 8 MGD the plant was built to handle. One day this past summer, for example, we ran almost 15 MGD. During July and August, average daily consumption was over 10 MGD.

"Finally, these ALOXITE filters were the least expensive and most easily installed type of bottom for our existing structure. We were very careful about the installation—and this care has paid dividends in the excellent condition of the porous plates, the hold-down bolts, and the joints between the plates."

CARBORUNDUM
Registered Trade Mark
Dept. X-128, Refractories Division, Perth Amboy, N. J.

NEW

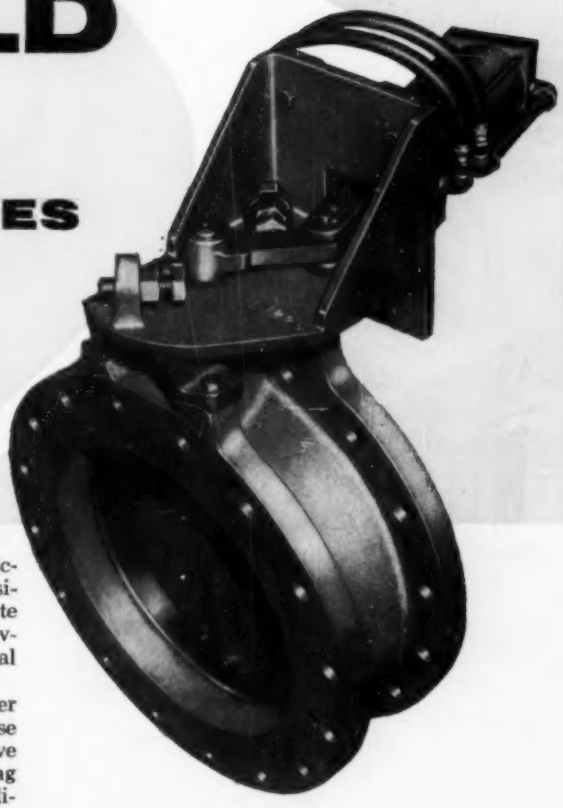
Advanced Design

LEOPOLD

AWWA

Rubber Seated BUTTERFLY VALVES

- **Low Initial Investment!**
- **Bubble Tight Shut-Off!**
- **Long Life— Low Maintenance!**



Offering new, improved features plus simplified construction, Leopold Rubber Seated Butterfly Valves provide positive drop-tight operation year after year, with an absolute minimum of upkeep. They're built for maximum space savings and may be mounted in any position to suit individual conditions.

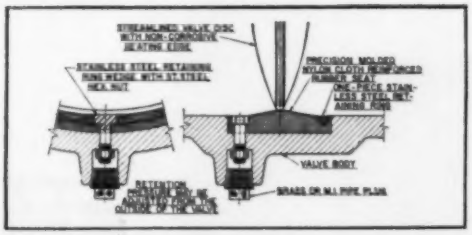
In this advanced design, a unique valve disc and rubber seat arrangement at the disc hub eliminates the major cause of premature seat failure. Only one moving part (valve disc) is in contact with the flowing medium, thus reducing wear and lowering the required operating torque. In addition, every Leopold Valve has a rugged flanged valve body, precision molded resilient rubber or synthetic seat, and heavy-duty corrosion-resistant operating parts.

Built in accordance with applicable AWWA specifications, Leopold Standard Butterfly Valves are available for line sizes 4"—48", with a choice of manual or various types of automatic operators.

For special control applications, LEOPOLD is equipped to furnish a specially designed, shop-tested, control package, which offers the advantage of full responsibility for the entire control system by a single reliable manufacturer.

NEW, EXCLUSIVE "UNI-WEDGE" SEAT RETENTION

This unique construction allows seat retaining pressure to be adjusted externally with the valve in place in the pipe line. Only two seat retaining screws are utilized which are not in contact with the flowing medium, minimizing erosion and corrosion of the seat retaining mechanism. Eliminates the need for numerous small seat retaining screws inherent in most available valve designs.



Write today for Bul. No. 5603.58

F. B. LEOPOLD COMPANY

ZELIENOPLE, PA.

seals right . . .

Lay Tyton Joint® pipe and relax.

Tyton Joint pipe is sealed tight . . . water-tight . . . by a specially designed rubber gasket that is compressed by the entering pipe.

Tyton Joint pipe is easy to work with, too. So easy even "green" crews become experts in minutes. No bell holes, no pouring snake, no caulking equipment . . . no nuts or bolts to

U.S. cast iron PIPE

FOR WATER, SEWERAGE AND

bottle tight

tighten. What's more, you can lay Tyton Joint pipe in rain or wet trench if need be. Result? More working days... fewer delays... time and money saved in the trench.

Want more facts about the economical joint engineers have called a most significant advance in cast iron pipe?

Write or call today.

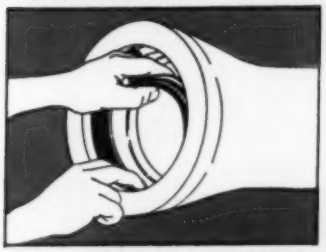
U.S. PIPE AND FOUNDRY COMPANY
General Office: Birmingham 2, Alabama

A WHOLLY INTEGRATED PRODUCER FROM MINES AND BLAST FURNACES TO FINISHED PIPE

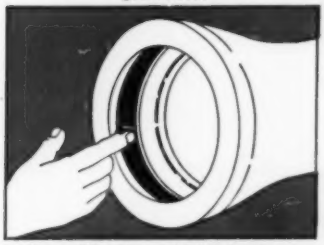
INDUSTRIAL SERVICE CAST IRON

TYTON

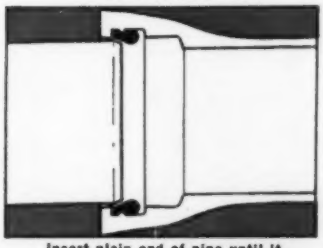
ONLY FOUR SIMPLE ACTIONS



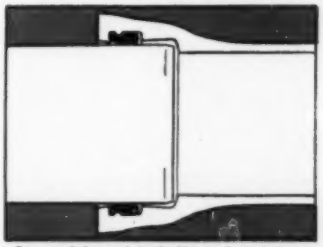
Insert gasket with groove over bead in gasket seat



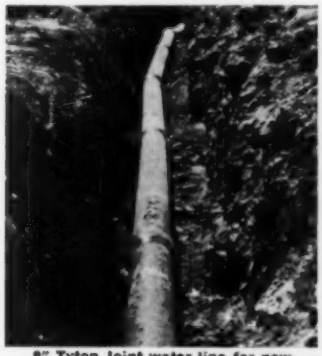
Wipe a film of special lubricant over inside of gasket



Insert plain end of pipe until it contacts gasket



Force plain end to bottom of socket... the job's done!



8" Tyton Joint water line for new high school in Alabama.

"Transite's installation recent increases

Says Philip J. Holton, Jr.
Chief Engineer
Water Supply Board
Providence, R.I.

"Our records show that labor and material costs have increased 100% since 1946. Yet, in this same period of time, our installation costs have increased only 21%. The ease of handling and speed with which contractors can lay Transite Pipe enable us to take full advantage of modern equipment and methods. In this way, Transite has played a prominent part in helping us offset increased costs."

Transite Pressure Pipe helps you cut system costs 3 ways: in design . . . installation . . . operation!

Today, in every part of the nation, municipal and consulting engineers choose Transite® Pressure Pipe. Ask why, and you find that economy is always among the Transite advantages they consider most important. For no pipe does so much to help keep your costs low in three different areas:

1. Design. Transite lets you plan a system for maximum efficiency. For its high carrying capacity (flow coefficient, C=140) often lets you specify pipe of smaller diameter. And because Transite's smooth interior remains smooth, you never need to make costly allowances for future reduction in carrying capacity.

2. Installation. Transite's installation speed cuts time and labor costs substantially. Light in weight for so durable a pipe, it handles easily above and below ground. And its Ring-Tite Coupling assembles quickly, surely . . . giving you a tight seal at every coupling in the system.

savings have helped us absorb in labor and material costs..."

Crews of Fanning and Doorley Construction Co. installing 8" line in Providence, R. I.

3. Operation. Here's where Transite really saves! For its maintained carrying capacity keeps pumping costs low year after year. Its strength, durability and corrosion resistance cut maintenance to a minimum, provide years of trouble-free service.

Transite's Ring-Tite Coupling cut away to show how rubber rings are compressed and locked in place to form a tight yet flexible joint.

We'll be pleased to send you booklet TR-160A. Write Johns-Manville, WS Box 14, N. Y. 16, N. Y.

"Good Water, the Lifeblood of your Community" Let's promote it—Let's have it!

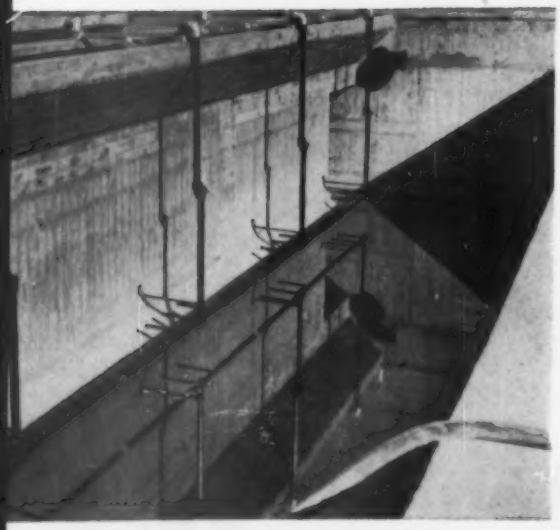
JOHNS-MANVILLE

100 YEARS OF QUALITY PRODUCTS . . . 1858—1958

JOHNS MANVILLE JM PRODUCTS

The Columbus, Ohio, Sewage Treatment Plant relies on wrought iron pipe's protective properties in tough, corrosive service

21 years in other corrosive services here support wrought iron again for new plant addition



View of wrought iron air diffuser piping in Columbus, Ohio's Sewage Treatment Plant

Wrought iron served so well, so long in corrosive services at the Columbus, Ohio Sewage Treatment Plant that engineers selected wrought iron again for use in the plant's new $2,500,000 addition.

On the job in the original plant for 21 years, wrought iron was used for all pipe services two inches and under. In the new addition, 90% of the wrought iron used was for guard railings 1½ inches in diameter. The remainder went into gas lines and miscellaneous piping, including the grease ejector mechanism vault and air diffuser piping.

AND NEW 4-D WROUGHT IRON LASTS EVEN LONGER

Today, specifiers and plant operating men are getting a wrought iron that is the most versatile material yet developed to help fight corrosion. New 4-D Wrought Iron faces corrosive attack with far greater resistance, even, than standard wrought iron.

It is available now from your distributor. Ask him about it. And write our Engineering Service Department for answers to specific piping problems. New 4-D Wrought Iron literature available upon request. A. M. Byers Company, Clark Building, Pittsburgh 22, Pennsylvania.

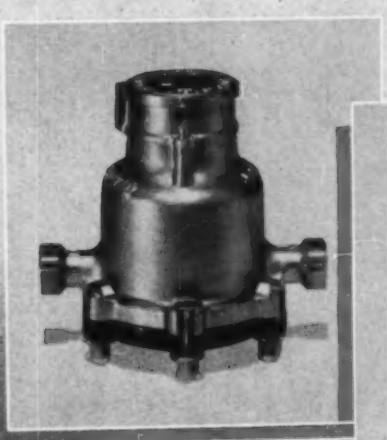
City of Columbus Sewage Treatment Plant Addition
Engineers: Uhlmann & Associates
Contractors: George S. Sheaf & Co., Inc. and E. P. Coody & Co. (A Joint Venture)
Fabricator: Columbus Metalcraft Co.

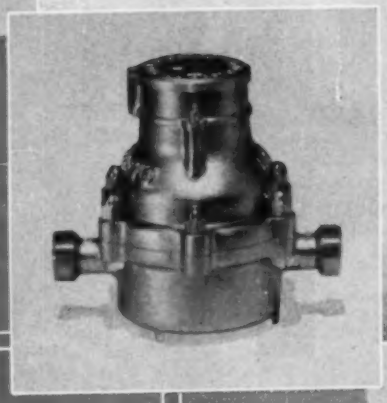
BYERS 4-D WROUGHT IRON

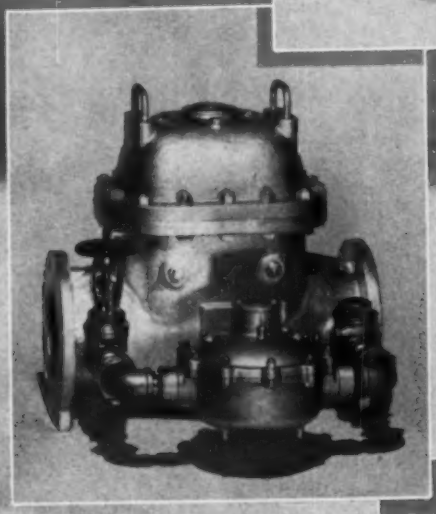
TUBULAR AND FLAT ROLLED PRODUCTS

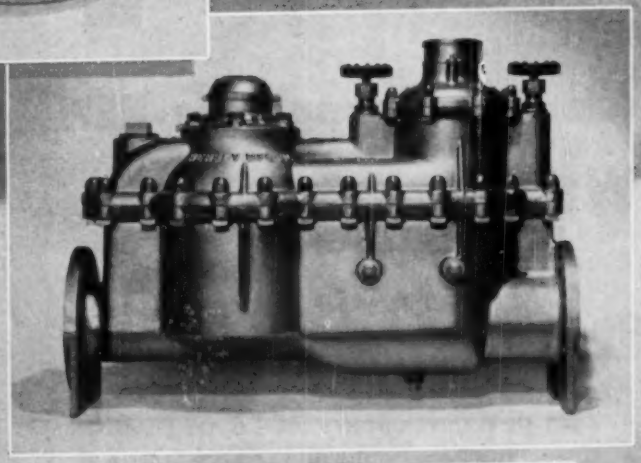
HERSEY
WATER METERS

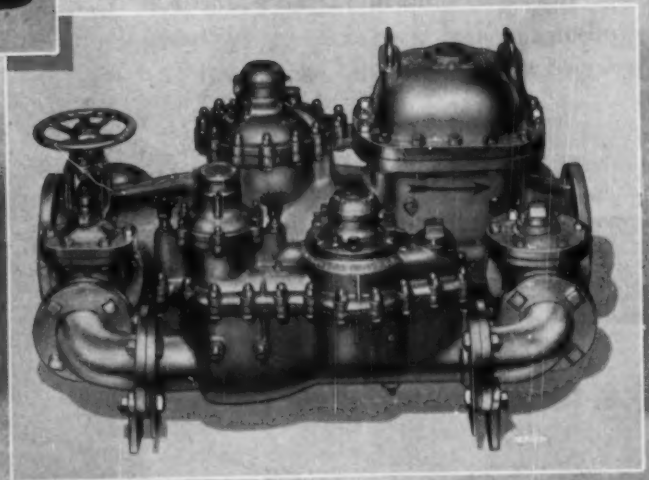
Your Best Buy For All Types of Services











HERSEY MANUFACTURING COMPANY
(Est. 1859)
DEDHAM, MASS.

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40% 40% 40%

MORE WATER

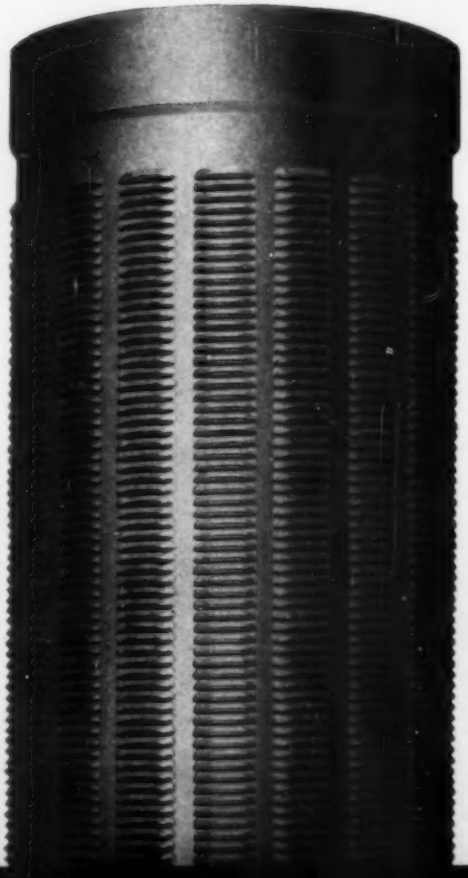
can flow through the NEW Layne 134 shutter screen

WHY? *Increased inlet area!*

Here's a screen that is even more efficient . . . has *greater strength* than the long-lasting Layne 96 shutter screen that made Layne water wells famous.

This new development of Layne creative research is used only in Layne water well installations, and available exclusively through Layne Associate Companies.

Contact your nearest Layne Associate Company for complete details.

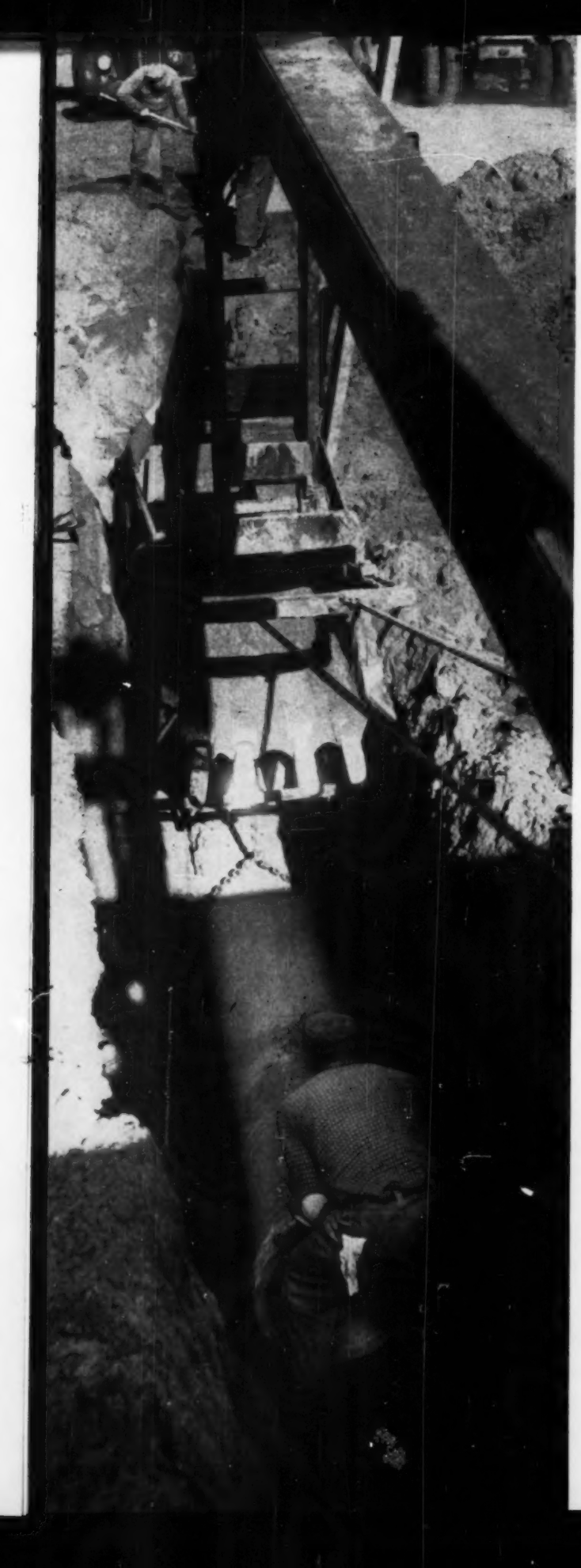


LAYNE & BOWLER, INC. MEMPHIS
General Offices and Factory
Memphis 8, Tenn.

Layne Associate Companies throughout the world.

Layne

WATER WELLS
VERTICAL TURBINE PUMPS • WATER TREATMENT



2 ways to lay prestressed concrete steel cylinder pipe

Here in Bossier City, La., the Yor-Wic Construction Co. of Shreveport is using two methods to install a 16 and 20-inch water line. At left the backhoe has dug the trench, lowered the 16-foot length of pipe, and is now shoving it home. In the picture above, where lightweight equipment was advisable, a tractor mounted backhoe has dug the trench, and a truck-mounted crane handles the pipe. The easy-to-make steel-and-rubber joint, and the extraordinary strength of this type pipe made both methods fast.

You can't see the reason for this pipe's strength because it is completely encased in concrete. Inside is a leakproof steel cylinder wrapped with high-tensile steel wire. It not only makes this pipe safe to handle, but gives it tremendous resistance to the effect of traffic loads, shifting soil, and sudden internal pressures. You just can't get a longer lasting or tougher pipe.

The high strength and long life advantages of this pipe offer the same benefit for Bossier City's new 16-inch sewer force main. Contractor for the sewer line is P & S Construction Co. of Shreveport. Engineers for both lines are Demopulos and Ferguson of Shreveport. Resident engineer is Donald Downs.

Pipe was manufactured by Price Brothers Company with headquarters plants in Hattiesburg, Miss. for the South and Dayton, Ohio for the North.

Price Brothers

Thirty more miles of concrete pipe were added to Milwaukee's sewer system in 1957, most of it 8" I.D.

In Milwaukee...

the entire residential sewer system is concrete pipe

Concrete pipe was chosen by Milwaukee in 1923 for its new residential sewage collecting system. All submains and mains have been included in this continuing program. Performance record? Not a single failure attributed to the pipe where it has served residential use.

That's because concrete pipe has uniformly high strength right from the start...and because concrete, by its very nature, grows stronger year by year.

Milwaukee chose concrete pipe because it meets the requirements of uniformity of strength—strength to carry all the loads—durability, availability and low initial cost.

Add maximum hydraulic capacity and long life. Put all these advantages together and it's easy to see why more and more municipalities are finding concrete is the answer to low-cost, trouble-free pipelines. Write for free literature, "*Concrete Sewers*," distributed only in the U.S. and Canada.

PORTLAND CEMENT ASSOCIATION

Dept. 12-29, 33 West Grand Avenue, Chicago 10, Ill.

A national organization to improve and extend the uses of concrete

FOR ALL MODERN PIPELINES

concrete

Them was the days...

Things just haven't been the same since they put in these *new*-fangled chlorinators. Joe . . . fellow that used to take care of the chlorinators . . . he was shifted to the pumps. Hardly ever get to see him at all anymore.

Then, where they used to have a whole slew of chlorinators, now they only have half as many. Something about "reliability"

Well, I don't know about this reliability stuff. Don't have too good a grasp of maintenance either. But it sure does get lonely around here nowadays. Even the *smell* is gone!*

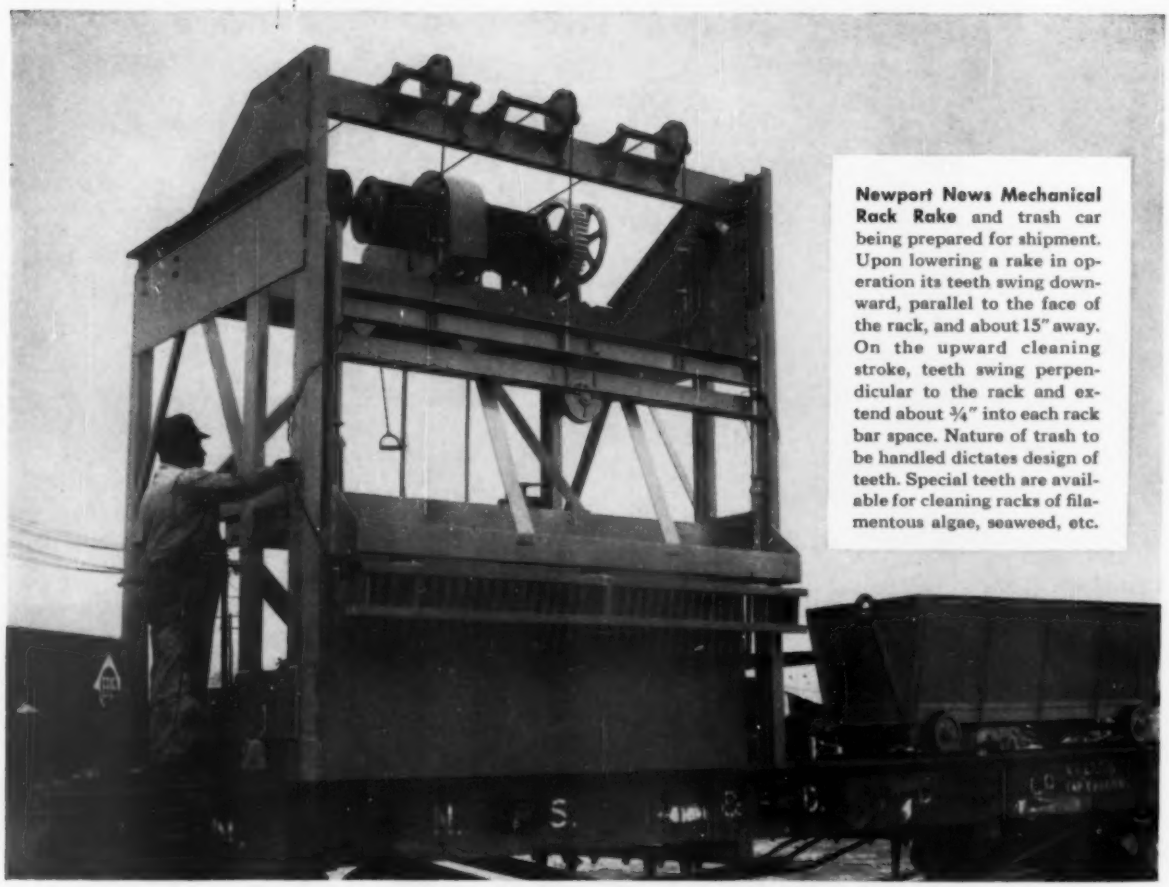
Personally, I happen to like the old-fashioned way of doing things. But it seems like everybody turned against me the day Fischer & Porter started making chlorinators.

If you like the old-fashioned way, all well and good. But if you don't, perhaps you'd better get the facts on new-fashioned chlorinators from Fischer & Porter Company, 228 Fischer Road, Hatboro, Pennsylvania.

FP FISCHER & PORTER CO.

Instrumentation and Chlorination

*Any wonder everyone's *trying* to copy F&P's design now?



Newport News Mechanical Rack Rake and trash car being prepared for shipment. Upon lowering a rake in operation its teeth swing downward, parallel to the face of the rack, and about 15" away. On the upward cleaning stroke, teeth swing perpendicular to the rack and extend about ¾" into each rack bar space. Nature of trash to be handled dictates design of teeth. Special teeth are available for cleaning racks of filamentous algae, seaweed, etc.

Positive cleaning action calls for guided rack rakes

Excessive loads of trash cannot push a Newport News rake away from the racks.

And there's no chance of the rake *riding over trash* on the upward cleaning stroke. Nor will its teeth drop the debris. Because Newport News builds the rake to operate in channel guides... for *positive cleaning action.*

That's why efficient rack cleaning assures the maximum head at intakes and is yours when you put a rugged and dependable Newport News Mechanical Rack Rake on the job.

Maximum width of a single rake is determined by design of the forebay. Where a single bay is extremely wide, intermediate guides are sometimes installed to reduce width of the rake. Such installation is relatively inexpensive.

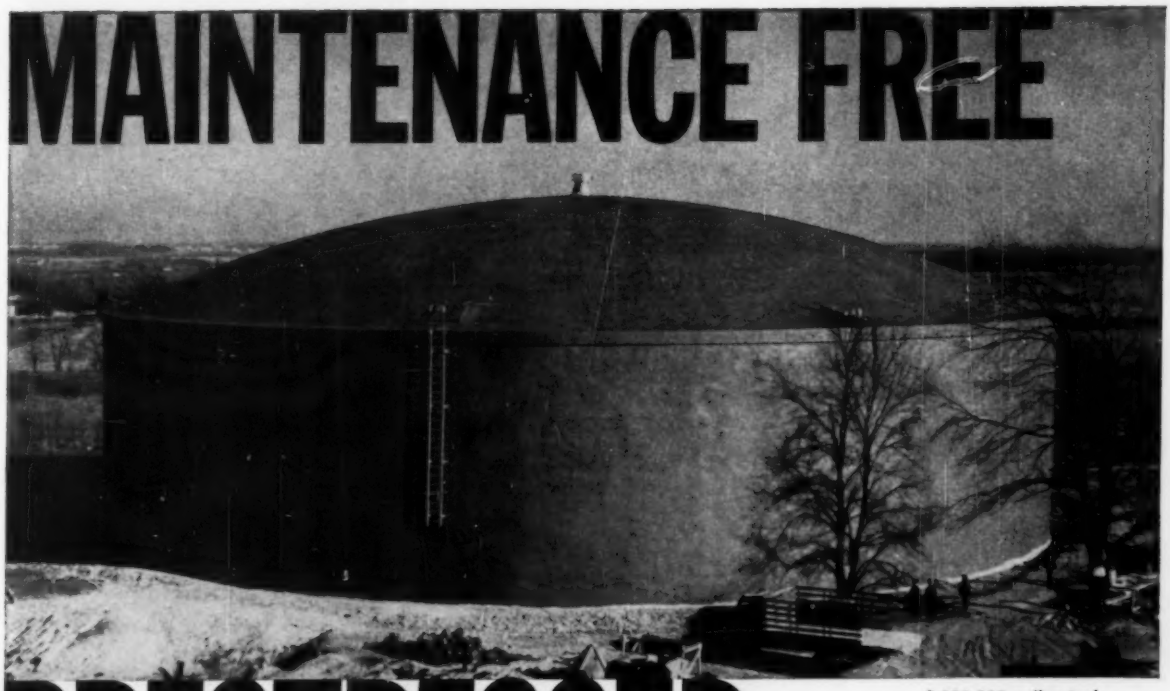
A power-operated Newport News Mechanical Rack Rake, under ordinary conditions, enables one man per shift to keep racks clean for a dozen bays, from 5′-6″ to 28′-6″ in width.

Trash is cleaned from the rake manually, or by a mechanical "sweep", into a flume, a car or onto a trash apron. Local conditions and nature of the trash dictate method of disposal. The many typical installation arrangements fit most needs, but each installation is a custom built job.

We invite inquiries from water users who are troubled with trash. Write for your copy of "RACK RAKE", an illustrated booklet describing the operation and advantages of the Newport News Mechanical Rack Rake.

Newport News
Shipbuilding and Dry Dock Company
Newport News, Virginia

MAINTENANCE FREE



3,000,000 gallon tank, Montgomery County (Dayton), Ohio

PRESTRESSED CONCRETE WATER TANKS

- No maintenance required
- Over 2000 tanks in service
- Owners never return to other types
- Lowest overall cost to community
- 75% construction cost spent locally

If your growing community has a water storage problem, by all means consider a Preload Prestressed Concrete Tank. Overall $ savings to your community can be phenomenal. Call or write today for more information. Send for Bulletin T-22.

THE PRELOAD COMPANY, INC.

211 East 37th Street, New York 16, New York

PRELOAD CONCRETE STRUCTURES INC.
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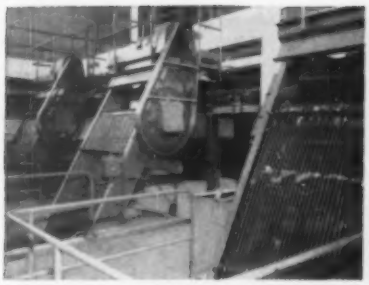
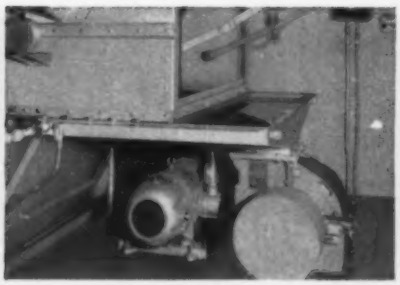
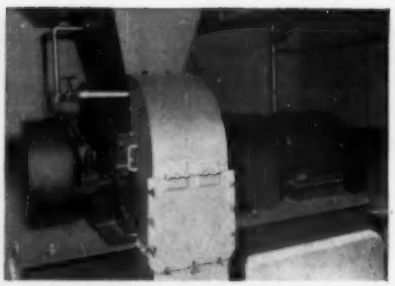
Montreal 16, Canada



Bar Screens—*mechanically back-cleaned units eliminate jamming at the bottom of screens.*



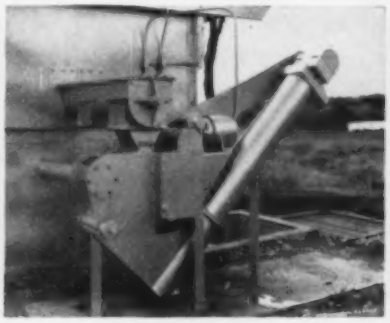
Screenings Grinders—*dispose of sewage screenings without increasing scum on primary tanks.*



Garbage Grinders—*make it practical to dispose of garbage through sewage treatment plant.*

Grit Collectors—*Scraper, elevator, V-bucket types . . . all gather, wash and elevate grit.*

Grit Washers—*remove more than 90% of putrescible solids . . . make grit suitable for fill, walkways.*



Floctrol® Process—*provides complete flocculation in shortest possible time and with minimum chemical dosage.*

Here's why JEFFREY is *right* on the job

. . . in hundreds of small and big volume plants

SIMPLICITY characterizes Jeffrey sewage treatment equipment, because it means low operating and maintenance costs.

DESIGN INGENUITY AND QUALITY CONSTRUCTION are part of each Jeffrey product because they are essential to efficient, trouble free, long lived performance.

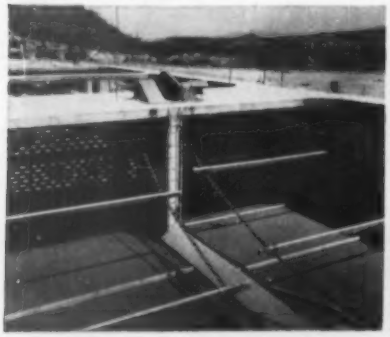
Nothing can be taken from . . . or added to . . . Jeffrey design specifications without sacrificing efficiency, operating convenience, economy or lasting qualities.

Jeffrey engineers apply this standard of perfection to everything we make . . . from the SUPERMAL chain on a sludge collector, to rates of agitation in our patented FLOCTROL process. The Jeffrey Manufacturing Company, 996 North Fourth St., Columbus 16, Ohio.

CONVEYING • PROCESSING • MINING EQUIPMENT . . .
TRANSMISSION MACHINERY . . . CONTRACT MANUFACTURING

JEFFREY

Sludge Collectors—*large carrying capacity permits intermittent operation . . . power savings, thicker sludge, clearer effluent.*

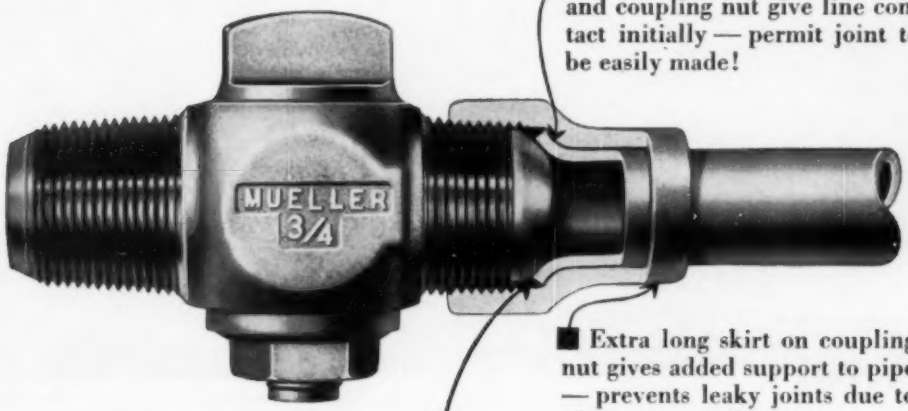


Scum Removers—*power-driven where accumulation requires almost continuous removal . . . rotating pipe type for occasional removal.*

Primary and Final Settling Tanks—*stable conditions of flow provide maximum solids removal in tanks of minimum size.*

MUELLER® CORPORATION STOPS

. . . *with* MUELLER
copper service pipe connection



■ Convex surfaces on stop body and coupling nut give line contact initially — permit joint to be easily made!

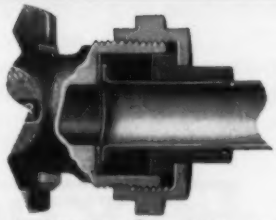
■ Extra long skirt on coupling nut gives added support to pipe — prevents leaky joints due to pipe movement!

Sizes from ½" through 2"

■ Opposed convex surfaces do not compress end of flange — give greater resistance to pipe pulling out.

NEW

INSULATING COUPLING OUTLET



H-15007 Sizes ¾" and 1"

Mueller corporation stops with insulating coupling outlet completely insulate copper service pipe from main to minimize electrolytic corrosion.

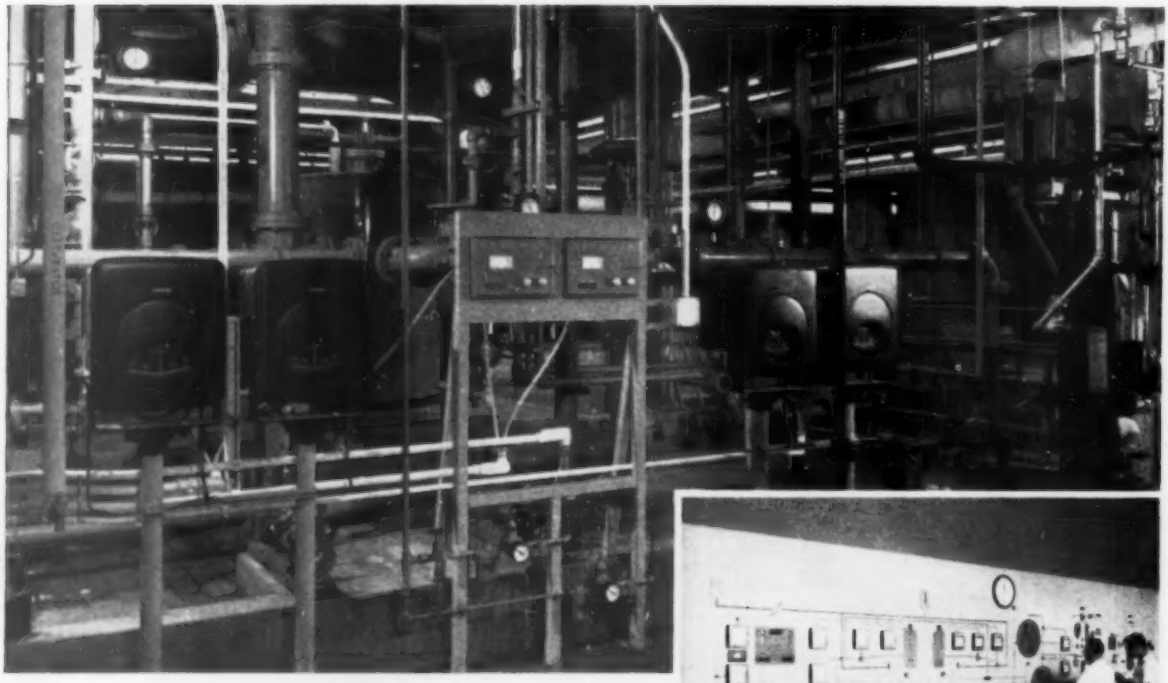
MUELLER CO.

DECATUR, ILL.

Factories at: Decatur, Chattanooga, Los Angeles; In Canada: Mueller, Limited, Sarnia, Ontario

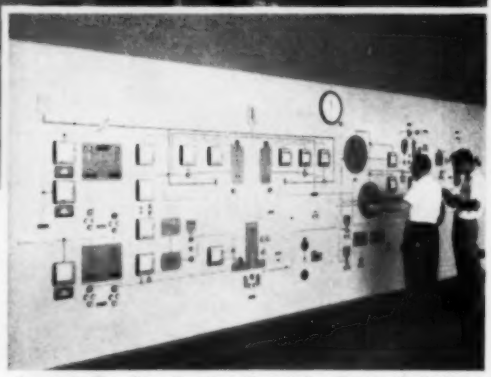
at **BOEING**
Airplane Company...

• Four Foxboro Dynalog oxidation-reduction potential transmitters form the heart of this Chromate Waste Reduction System at Boeing Airplane Company. Dynalog instruments transmit pneumatic signal to remote control panel (below). Two Beckman pH Amplifiers can be seen in the center. Consulting engineers: Wilson & Company, Salina, Kansas.



TOXIC CHROMATE WASTE

is rendered harmless



Central Graphic Control Panel for Boeing's Industrial Waste Treatment Plant. Panel includes controllers for flow and liquid level of various tanks, as well as recorder-controllers for the Foxboro ORP meters.

using Foxboro continuous waste control system

At the Boeing plant in Wichita, Kansas, toxic hexavalent chromate waste from plating tanks must be reduced to trivalent chromium. Control of this complicated reduction process is handled by a Foxboro Continuous Waste Control System.

Four Foxboro ORP (oxidation-reduction potential) Meters are the heart of the system. These sensitive instruments take continuous ORP electronic measurements — pneumatically control addition of sulphur dioxide when oxidation potential starts to rise.

Simple or complex — waste treatment systems are everyday business for Foxboro. Years of experience, plus pace-setting instruments like the Foxboro Magnetic Flow Meter, the Foxboro Dynalog* Recorder, and the Foxboro ORP Recorder have made it possible.

Write us about your industrial waste treatment problem. We'll be glad to send you literature — or have an engineer call on you at your convenience. **The Foxboro Co., 8912 Neponset Ave., Foxboro, Mass.**

*Reg. U. S. Pat. Off.

FOXBORO
REG. U.S. PAT. OFF.
WASTE CONTROL SYSTEMS

The Mathews barrel, containing all working parts of the hydrant, is readily removed for inspection or repair by simply unscrewing it from the elbow and withdrawing it through the protection case.

I want you to see for yourself how the Mathews replaceable barrel is a real community asset

I can show you easily and quickly with this scale model. See? When a Mathews is broken by a skidding automobile, you can slip in a new barrel in a matter of minutes, *and without excavating.* It's a real safety feature for the community—allows only momentary interruption of neighborhood fire protection.

And these additional quality features help keep the Mathews at the head of the line:

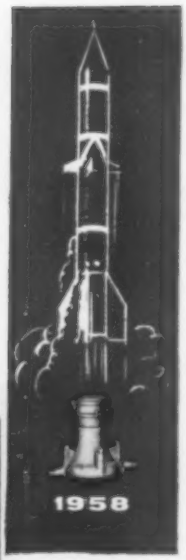
- Compression-type valve opens against water pressure—a positive leakproof construction
- Operating thread cannot be bent
- Head revolves 360° just by loosening bolts
- Nozzle sections are changeable
- Nozzle levels can be raised or lowered without excavating
- Bell, mechanical-joint or flange-type connections
- O-Ring seal furnished when specified

MATHEWS HYDRANTS—by **R. D. WOOD COMPANY**

Public Ledger Building, Independence Square, Philadelphia 5, Pa.

Manufacturers of "Sand-Spun" Pipe (centrifugally cast in sand molds) and R. D. Wood Gate Valves

The meter you buy today...



will it meet *1988* standards?

When buying new water meters, a most important question of cost is: "In 30 years will this meter be *scrapped*, or will it be rebuilt to *1988* standards at a fraction of the cost . . . ready for years more accurate service?"

Take a look at the *past* 30 years. Think how much you're saving *this* year on Trident meters installed back in 1928 . . . or even 30 years before that.

Under Trident's strict policy of interchangeability, all improved parts are designed to fit old Tridents too. These up-to-date Trident parts embody every thoroughly tested advancement known to metering science. Not only is repairing easy and economical, but also you actually modernize your Tridents as you go.

This has been a rigid Neptune policy for 60 years. ***Every design improvement now on our drawing boards will continue it.*** It's your best assurance that the Tridents you buy today will stay modern, earning maximum revenue for your water system . . . at lowest cost . . . for many years to come.

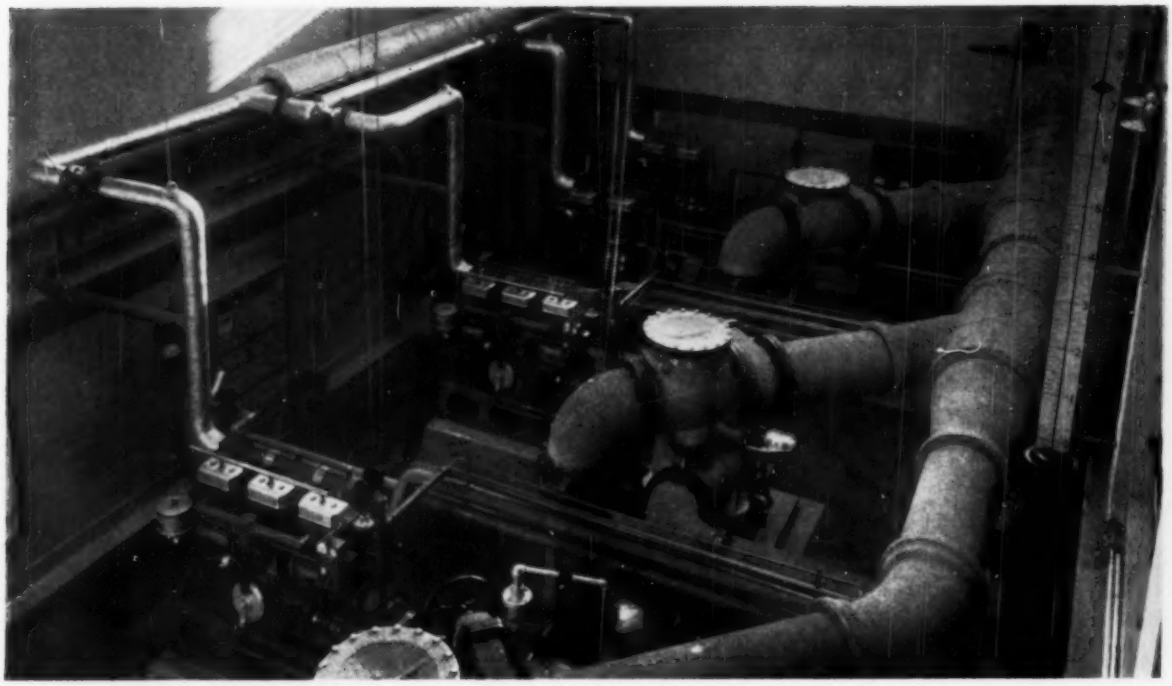
NEPTUNE METER COMPANY
19 West 50th Street • New York 20, N. Y.
NEPTUNE METERS, LTD.
1430 Lakeshore Rd. • Toronto 14, Ont.
Branch Offices in Principal American and Canadian Cities.

neptune
TRIDENT WATER METERS

Vol. 105, No. 12 · December, 1958

A Scranton Gillette Publication

WATER & SEWAGE WORKS



THESE clarified-sewage pumps and engine-generator units account for the major part of . . .

Sludge Gas Utilization *at Aurora, Ill.*

by WILLARD P. PFEIFFER,
Assistant Superintendent,
Aurora, Ill., Sanitary District.

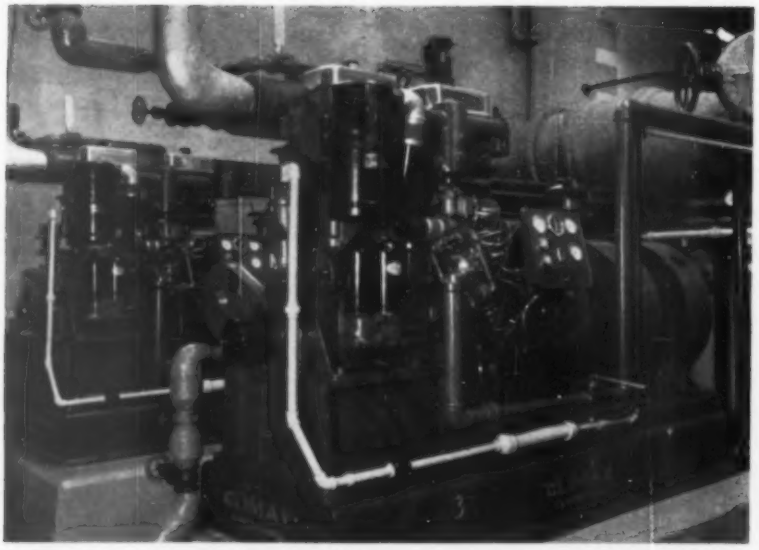
EDITOR'S NOTE: The experiences in the utilization of sludge digester gas at Aurora, Ill., not only make interesting reading, but also provide a guide for other plants. In addition, the author has presented a brief review of the history of sludge gas utilization and notes on volume and composition of gas, gas purification, hazards and safety practices, and collection and storage of gas. This material was presented at an Illinois Sewage Works Operators Short Course.

■ THE UTILIZATION of sludge gas covers such a broad and varied field that the comments herein for the most part relate experiences at the Aurora Sanitary District's sewage treatment plant.

The digester system of a sewage plant producing gas is one function in the processing of sewage for its safe return to the receiving watercourse. Every operator must always bear in mind that the chief function of the plant in his charge is to treat the sewage through its various processes and render the effluent to the receiving watercourse as free of suspended solids and oxygen-demanding material as the facilities available in his particular plant will possibly permit.

History of Gas Utilization

Sewer gas was first obtained from sludge digestion in Exeter, England, in 1895 and burned in a street lamp. In 1902, James used gas from a septic



TWO engine-generator units, using sludge gas as fuel, supply plant light and auxiliary power requirements. Heat exchanger on engine cooling water system heats building and partially heats digesters.

tank at a leper colony near Bombay, India, for operating a gas engine. The first utilization of gas in the United States was at the Peachtree sewage plant in Atlanta, Ga., where Homman capped the gas vents of his Imhoff tanks and used the gas so collected for home heating and cooking.

The first application of sludge gas for heating a sludge tank or digester in the United States was in 1926 at Plainfield, N. J., and Antigo, Wis. In this same year gas collected at Plainfield, N. J. was used to drive two gas engines.

Since 1926 slude gas has had many uses including building heating; digester heating by the coil system; driving pumps, blowers and generators; digester heating by sludge circulation through a boiler and heat exchanger unit; incineration; gas recirculation in the digestion process; and many others. A number of plants are so arranged that they sell their surplus gas or surplus generated power to the local utilities. At Johannesburg, South Africa, and some European plants digester gas has been compressed in cylinders and utilized as truck and tractor fuel.

Volume and Composition of Gas

Factors governing the volume of gas obtained from digestion include the extent to which the sludge is digested, its character, and the available volatile matter in the raw or combined sludges.

The volume of gas to be expected may range from 0.5 to 1 cu ft per capita per day, depending on the inclusion of gas-producing industrial wastes. Inclusion of certain wastes will increase the per capita production to well beyond the 1 cu ft per day quantity.

The composition of the gas is a function of the completeness of the digestion, but will generally average about as follows:

Constituent	*Formula*	*Content*
Methane	CH_4	60 to 75%
Carbon dioxide	CO_2	35 to 20%
Hydrogen	H	Trace
Nitrogen	N	Trace
Oxygen	O	Trace
Hydrogen sulfide	H_2S	Trace
Gross heat value		550 to 750 Btu/cu ft

By comparison, the 1956 average composition of Aurora's digester gas was as follows:

Constituent	*Formula*	*Content*
Methane	CH_4	62.1%
Carbon dioxide	CO_2	32.9%
Hydrogen	H	0.3%
Nitrogen	N	0.3%
Oxygen	O	0.5%
Hydrogen sulfide	H_2S	92 ppm
		4.2 100 cu ft
		0.0009 by wt.
Heat value, gross		629 Btu/cu ft
Heat value, net		571 Btu/cu ft

The net heat value of gas is determined by deducting from the gross heat value the heat required to evaporate the water in the gas or produced during combustion.

The hydrogen sulfide content of sludge gas will vary according to the sulfates present in the raw sewage; therefore, it will reflect in part the sulfate content of the water supply of the area served. The sulfate content of the city wells in Aurora ranges from 1.6 to 8.0 grains per gallon.

Gas Purification

Prevention of corrosion of gas boilers, engines, blowers, and other equipment is a matter of great concern. Fortunately, at Aurora the amount of hydrogen sulfide contained in the sludge gas is so small that it has not created a purifying problem. If present in any quantity, however, the dry, or iron oxide, process can be used for the purpose of removing hydrogen sulfide. In this method the gas is passed through one or more boxes containing wood shavings and iron oxide, thereby converting the iron oxide to iron sulfide. The iron oxide after a time loses its effectiveness and must be renewed by exposing the exhausted iron oxide in thin layers, moistened with water and a small amount of soda ash, to the air. The iron oxide should be renewed when it has absorbed about 50 per cent by weight of sulfur.

Hazards and the Safety Problem

Care must be given to the safety features of design and operation of all gas utilizing equipment.

Journals and magazines dealing with water, sewage and industrial wastes have carried extensive articles on the explosions that have occurred from sludge gas. Sludge gas explosion hazard will exist when there is a mixture in the ratio of 1 part of gas to 7 to 10 parts of air. Every operator should have in his library Manual of Practice No. 1 entitled, "Occupational Hazards in the Operation of Sewage Works," published by the Federation of Sewage and Industrial Wastes Associations. *Waterworks and Sewerage* in September 1941 carried an article "Elimination of Gas Hazards at Sewage Treatment Plants," which covers this problem rather completely.

All gas collecting systems should be positively sealed tight. Furthermore, all buildings and galleries where

gas is collected or may collect should be adequately vented by forced-draft fans.

Purging of all gas collecting and distribution lines after repair or maintenance is definitely good practice. Likewise, when and if it becomes necessary to work on the inside of a discharged digester, proper purging with forced air is definitely a "must."

Flame traps should be provided on all gas burning equipment. It is advisable to occasionally check the flame trap for its proper functioning and follow this by removing the wire gauze and cleaning it. A supply of fusible links and accessories should be maintained at all times.

Pressure relief and reducing valves, although reliable, need periodic inspection for their continued dependable service. All diaphragms on relief valves should be vented to the outside atmosphere.

Although not essential, at Aurora it has been found that by providing a by-pass line around the sludge gas meters uninterrupted service is accomplished when it becomes necessary to remove the meter for repair or replacement and air is prevented from entering the system during this operation.

Hydrogen sulfide, which has a rotten egg odor, is one of the minor components of sludge gas; but it is fatal in 30 minutes or less at concentrations of 0.06 to 0.10 per cent, and will cause severe illness at concentrations 0.05 to 0.07 per cent. Concentration of hydrogen sulfide greater than 2,000 ppm (0.2 per cent).

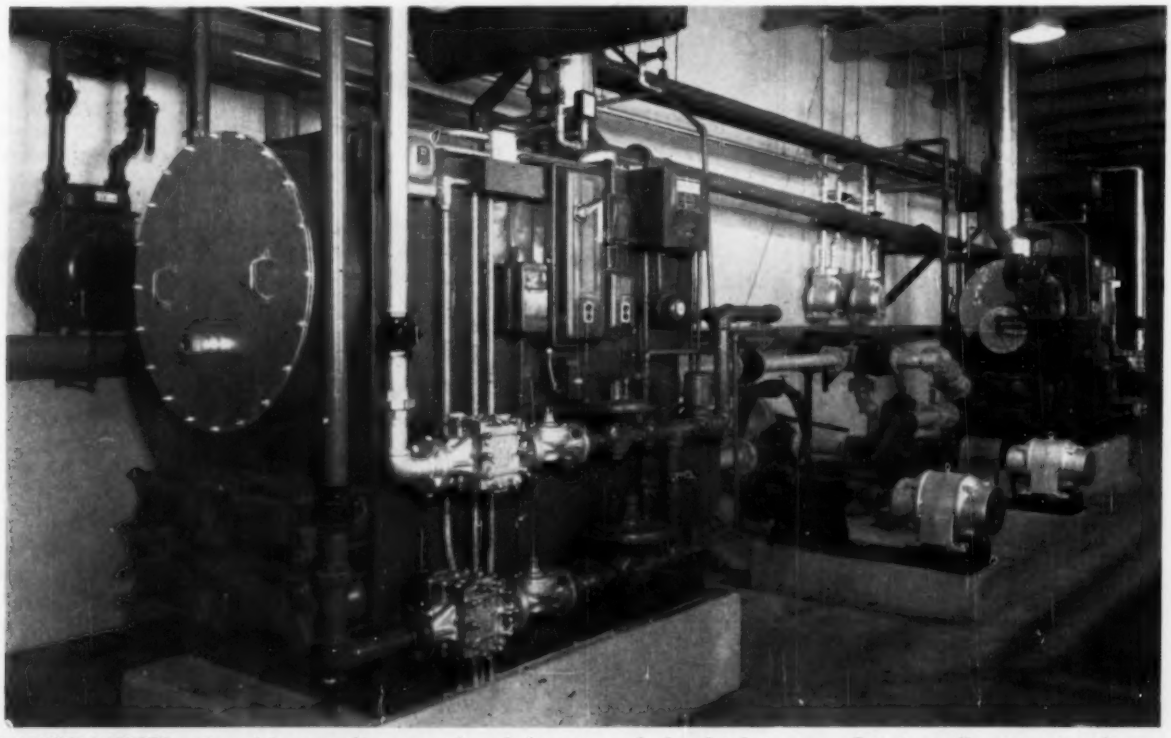
Filter paper in ½-in. wide strips immersed in a lead acetate solution (10 per cent) and allowed to dry provides the operator with a quick method for detection of hydrogen sulfide. The filter paper is placed in the area under observation and in the presence of hydrogen sulfide will change to a brown-black color.

Collection of Sludge Gas

As long as the collecting and distribution system is under positive pressure no air can enter the system to produce an air-gas mixture and no hazard will result.

On outside digester gas lines it is well to insulate the lines with frostproof-type insulation in order to keep the gas coming off the digester at or near the digester temperature, thus avoiding condensation in the collecting system. Some difficulty was experienced at Aurora in placing new sludge gas meters in an enclosed room, about 35 ft from the gas collecting dome, and provided with drip traps preceding the meters. The amount of condensate in the collecting system was sufficient to partially fill the meter chambers, and occasionally to cause them to run backwards. This problem was solved by repositioning the meters in the control room housing the sludge heat exchanger units, where it is quite warm. Condensation problems in sludge gas collecting lines are a matter of controlling the dewpoint. More favorable conditions are present for dewpoint control when the temperature of the gas released from the digester is less than that of the surrounding air. Conversely, when the sludge gas temperature in the gas released from the digester exceeds that of the surrounding air dewpoint problems arise or are increased.

In addition to the drip trap and check valve installed near the gas dome, a dogleg drip trap was provided on the inlet side of the meters to further collect the condensation formed. This solved this problem. Experience



INTERCONNECTED external heat exchangers using sludge gas as fuel maintain two new first-stage digesters at optimum temperature automatically.

after 20 months of operation indicated that the greater portion of the condensation was removed at the drip trap and check valve near the gas dome. Condensation is removed from all gas collecting meters on every 8-hr shift, and oftener if necessary. On all gas collecting meters pet cocks or valves have been installed to drain the bellows system in the meter chambers. The life of the gas meters and the collecting system can be prolonged if the condensation problem is adequately recognized.

Through Aurora's experience with gas collection it has definitely been concluded that the installation of cleanouts in the gas lines from the digester to the distribution header provides for a reasonable way of cleaning of the iron sulfide scale on the pipe interior. Cautious pounding of the pipe system, followed by flushing with water, will remove the bulk of the scale. Once this is accomplished the collecting system should be adequately purged to discharge air that has entered the collecting lines during these operations.

Among the never-ending maintenance requirements of a sewage treatment plant is periodic inspection of the check valves in the gas collecting system. The drip pots and gas seals must likewise be included in this maintenance program.

Two of the gas meters serving the secondary digesters at Aurora are installed in the digester house not far removed from the gas dome and subjected to almost outside temperature conditions. Condensation was not sufficiently collected in the drip trap, with the result that a portion of the condensate found its way into the meter chambers. After various solutions were suggested to prevent this condition, the matter was solved by building around these two gas meters a Celotex room, with inspection doors, and providing a number of heat lamps to keep the room at a temperature sufficiently high to prevent an appreciable amount of condensation within the meter body. This has proved very effective in condensation control.

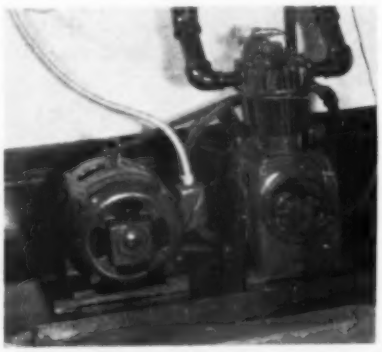
Waste Gas and Gas Storage

The function of the waste gas burner is to burn the excess gas to the atmosphere to prevent possible hydrogen sulfide odor. There are many forms of the waste gas burner available; or an operator can design and fabricate his own burner to meet his specific needs. Such a burner should be placed in a well-protected area and removed from other gas utilizing equipment.

Because sludge gas production at times is at an irregular rate, it is necessary to provide some form of storage tank that will act as a reservoir between the supply and the demand of plant equipment. Three forms of storage in use are: (a) the dry-seal gasometer, (b) the floating reservoir, and (c) the pressure holder. At Aurora, pressure storage provides 11,000 cu ft of gas at atmospheric conditions.

Gas Utilization Equipment at Aurora

The sewage treatment plant at Aurora is of the separate sludge digestion type. Originally, in 1929, sludge digestion capacity was 120,000 cu ft, but this was increased to 200,000 cu ft in 1956. The estimated population now served is 65,000. The average daily flow handled by the plant in 1956 was 8.770 mgd.



COMPRESSOR used to transfer sludge gas from low-pressure distribution header to high-pressure (65 psi) storage tanks.

The first use of sludge gas at Aurora was in the interconnected low-pressure boilers providing building heat, the heating of approximately 140,000 gal of water per day in the digester coil system of the then three digesters, and for miscellaneous purposes in the plant laboratory. Temperatures in the boilers were maintained below 160°F to avoid lime scale deposits in the circulating coil system. The boilers were provided with the then conventional automatic and protective controls.

After installation of the sludge gas pump and generator engines, the use of digester gas in the low-pressure boilers was decreased due to the 60 per cent, or more, of heat recovered in the exhaust heat exchanger. From 1936 on, the boilers were only used to provide supplemental heat, as required, for sufficient building heat and optimum digester temperatures.

In 1953, natural gas became available in the plant area for process work. At that time the boilers, which had previously been interconnected, were separated so as to provide one boiler for building heat on digester gas and the other boiler for digester heating and screenings incineration on either digester or natural gas. This digester hot water heating boiler was then provided with two sets of burner orifices so that one-half of the boiler could be operated on sludge gas while the other half was operated on natural gas.

In 1931 a Midwest incinerator was installed in the screen house to incinerate screenings removed from the raw sewage and the grease and scum skimmed from the four clarifiers. This incinerator was designed to burn not less than 1 cu ft of screenings and 1 cu ft of grease and scum per hour, with stack gases above 1,500°F to be free from objectionable odor. Gas consumption was not to exceed 7,000 cu ft of sludge gas per 24 hr with a Btu content of not less than 500, for the burning of screenings having a moisture content of about 80 per cent and grease and scum with a moisture content of about 60 per cent. Explosion dangers through the failure of gas pressure were eliminated by installation of an automatic gas shut-off valve in the supply line.

Experience with this incinerator has been satisfactory. It removed the problems of screenings burial and the disposal of grease and scum accumulations from the clarifiers, and removed the possibility of odor problems in the neighborhood. This incinerator is still in service, although incineration of grease and scum has been abandoned in favor of digestion in the digesters. In 1953, when natural gas was made available to the plant, the incinerator was equipped to operate on the natural gas supply.

In 1934, a LeRoi 11-hp, 4-cylinder, stationary sludge gas engine direct-connected to an Aurora 4-in. centrifugal pump was purchased to be used for the dewatering of the clarifiers

and filling digesters with raw sewage after they had been discharged to the drying beds. This gave another use for the by-product of digestion. The engine was used only intermittantly under the plant operating conditions, but it served the plant effectively until 1955, when the gas engine was replaced with a used 10-hp electric motor as being, at that time, better adapted due to the problems encountered in starting the gas engine for infrequent use.

During this same year a second Le-Roi 11-hp 4-cylinder, portable gasoline engine direct-connected to a 4-in. centrifugal pump was used for dewatering operations throughout the plant. It became necessary to dewater one of the settling tanks of the secondary unit for repairs. The idea of trying to operate this gasoline engine on sewer gas was considered and eventually such a project was undertaken by installing the carburetor of the sludge gas engine on the gasoline engine unit. A garden hose was attached to the sludge gas supply line in the secondary pumphouse building and connected into the carburetor system. The engine performed without difficulty and this new adventure on sewer gas use saved approximately 100 gal of gasoline on this one operation alone.

Pump Engines

The plant is located about 5 miles downstream from Aurora on Fox River. No pumping of raw sewage is necessary; practically all of the flow is brought by gravity to the screen house for treatment. Clarified sewage must, however, be lifted about 27 ft to the dosing chambers of the sprinkling filters. From the beginning of operation in 1929 this was accomplished by lifting the clarified sewage with one of two 75-hp motors attached to 8-mgd centrifugal pumps. In addition there was provided a 50-hp motor connected to a 6-mgd centrifugal pump for stand-by service.

In March 1936 the two electric motors were replaced with two Climax 75-hp, 6-cylinder, low-speed (550-800 rpm) gas engines direct-connected through flexible couplings to the existing 8-mgd pumps. The engines are equipped with the usual air filters, oil filters, and safety devices to protect the engines from overheating and loss of oil pressure. The gas supply system is protected by flame traps and pressure relief valves. Gas storage facilities were provided to help bridge low production periods from the digesters. Sludge gas is taken from the distribution header and passed through a small surge tank before compressing it from about 10-in. water column pressure to a maximum of 65 psi in the storage tank. The system is provided with a muffler system for noise control. Although the storage facilities of but 11,000 cu ft of gas at atmospheric conditions is small, inclusion of this storage tank has been more than worthwhile in bridging many low gas production periods for the continuous operation of both the pump and generator engines.

STORAGE tanks provide only 11,000 cu ft at atmospheric pressure, but hold over most low gas production periods.

The speed of the engine is controlled by a float-operated mechanism operating over a drum attached to the governor of the engine, which increases the engine speed on a rising wet well level and decrease it on a receding level in the well.

Exhaust temperatures from the engine system ran around 800° to 950°F. Exhaust gases originally first passed through a muffler system and then were directed through the exhaust heat exchanger to radiate heat to the digester water circulating through the heat exchange. This provided a recovery of about 60 per cent of the heat supplied to the pump engines.

After several years of operation the muffler system was discarded to provide higher exhaust temperatures to the exchanger in the hopes that this would tend to prolong the life of the wrought iron tubes in the exchanger due to corrosion in the tubes when the temperatures were below the theoretical dewpoint of 130°F. The average life of the wrought iron tubes in the exchanger was about 4½ to 5 years before replacement was necessary. Within the last two years the design of the exhaust heat exchanger was modified so that the exchanger was shortened by 4 ft. This results in a more uniform exhaust temperature through the unit, averaging well above 200° F and far above the theoretical 130° dewpoint for the elimination of corrosion. At this time the unit was re-tubed with stainless steel tubes. So far this change has given no trouble and the additional cost of the stainless steel tubes seems well justified.

Data from the 1956 Annual Report of the District give an over-all picture of operations with these two pump engines from April 1, 1936, to January 1, 1957 as follows:

Operation time, total, hr	164,124
Operation time, % of poss	90.2
Power devel., total, hp-hr	7,110,071
Power devel., avg, hp-hr	43.31
Avg % of rated hp (75)	57.75
Pumpage, total, mil gal	46,546.58
Pumpage, avg, mgd	6,850
Sludge gas used, total, cu ft	127,603,100
Sludge gas used, avg, cu ft day	18,600
Gasoline used, total, gal	27,328
Nat. gas used, total, cu ft	2,743,900
Equiv. sludge gas, cu ft	4,346,000
Gas used per hp-hr, cu ft	17.95
Avg heat value of gas, Btu	583
Avg Btu per hp-hr	10,500
Motor oil used, gal	1,870
Total maint. cost (incl. gasoline, natural gas and motor oil)	$25,987.50

The gross savings in pumping costs for this period, based on the prevailing power costs, amounted to $89,792.92. Repairs, maintenance, oil, gasoline, natural gas, and stand-by power for operating the 6-mgd low-lift centrifugal pump for this same period amounted to $30,074.79. The net saving in pumping costs for this 249-month period was $59,536.13, or a return of 703 per cent on the net investment in this pump engine installation cost of $8,521.50.

Generator Engines

The gas production history and experience with the gas pump engine units installed in 1936 were so favorable that in November 1940 two 50-hp, 4-cylinder, 720-rpm Climax gas engines, direct-connected to two Electric Machinery 35-kw, 440-v, 60-cycle, 3-phase, synchronous generators were installed with the necessary automatic synchronizing switchboards and safety equipment. These generators were to provide all power and light for the 27 or more auxiliary motors in operation at the plant. At this time all outside power connections were severed with the local utility and the plant was "on it own."

Having the generator engines of the same type and piston size as the pump engines provided the advantage of interchangeable parts on these engines. The generator engines were air-start, dual-magnetoed for the 12-v ignition system. They use either sludge gas or gasoline, or both. The engines, like the pump engines, are operated continuously and alternated every other week. The dependability of these generator engines is evidenced by the fact that they have been in operation for 99.57 per cent of the total elapsed time since their installation. Experience with this equipment has been more than favorable, with maintenance and repair costs nothing more than the normal expectancies of any mechanical and electrical equipment.

The low hydrogen sulfide content of the Aurora sludge has not created any corrosion problem within the engines.

Data from the 1956 Annual Report give an over-all picture of operation of these two generator engines from November 1, 1940, to January 1, 1957, as follows:

Operation time, total, hr	141,114
Operation time, % of poss	99.57
Power produced, kw-hr:	
Power	1,388,275
Lights	270,321
Total	1,658,596
Power devel., total, hp-hr	2,777,989
Power devel., avg, hp-hr	19.70
Avg % of rated hp (50)	39.4
Power devel., avg, km-hr/day	282
Sludge gas used, cu ft:	
Total	70,337,600
Per day	11,960
Per kw-hr	42.5
Per hp-hr	25.3
Avg Btu per hp-hr	14,820
Avg Btu per kw-hr	24,725
Gasoline used, total, gal	4,786
Equiv. to sludge gas, cu ft	991,500
Motor oil used, gal	1,468.5
Total maint. cost (incl. repairs, gasoline and motor oil)	$13,215.18

WASTE gas burner on office and laboratory building roof.

During the 193 months of generator operation they were out of service only 606 hr, or 0.43 per cent of the total elapsed time. The generator engines and appurtenances were installed at a cost of $9,800. Gross saving for this period has amounted to $36,433.12 based on the prevailing power and light rates. Maintenance, repairs, oil, and gasoline charges for this same period totaled $13,215.18, producing a net saving of $23,217.94 in power and light cost for this 193-period. This has produced a net savings equivalent to a 236 per cent return to the District on this engine-generator investment.

Natural Gas

The available digester gas in the pressure storage tank has not always been sufficient to bridge the low gas production periods. Therefore, it became necessary to operate either the pump engines or the generator engines on the auxiliary gasoline fuel during these periods. Gasoline operation was rather expensive, produced a diluting effect on the crankcase oil, and left the engine not as clean internally as under the normal gas operation.

When natural gas was made available in the plant area for pumping purposes, a study revealed that a considerable saving was to be had by providing the plant with natural gas for pumping the clarified sewage to the filters by the two 8-mgd pumps during periods when sludge gas production was inadequate for this operation. In 1953 a natural gas line was run into the plant for this purpose; no appreciable use of gasoline as a fuel for the pump engines has been made since then.

At present, it is understood that natural gas is available in the plant area for power generation. Under current plant operating conditions and anticipated increase in digester gas production it is assumed that the use of natural gas as fuel for power generation will not be considered at present.

External Sludge Heater

With the constantly increasing solids load being imposed on the treatment plant by the fast growing limits of the Aurora Sanitary District and the anticipated building boom, it was evident that the digester system was overloaded and needed additional capacity. Consequently, in 1956 two additional first-stage digesters were installed. With this addition the total digester capacity was increased to 200,000 cu ft.

In conjunction with the additional digesters two Walker external heat exchanger units were installed. Each unit consists of a 500,000-Btu per hr boiler, a 500,000-Btu per hr heat exchanger, and a 250-gpm 4- by 4-in. non-clog pump for circulating digester sludge through the exchanger to the digester. The necessary electrical and gas control safety features were provided in these units for the safe operation of all equipment installed. Piping was so aranged that either unit can supply heat to either of the two new digesters.

In addition, one of the digesters was equipped with 800 ft of 1¼-in. wrought iron internal heating coils. The advantage gained in this arrangement was that surplus heat from the

heat exchanger of the pump and generator system was utilized to help maintain optimum temperature conditions within this digester and at the same time conserve the use of sludge gas in the operation of the heat exchanger system. At the same time it was possible to keep the engine jacket water temperature below 190°F, particularly during the summer months. Previous to this installation the excess engine water heat had to be dissipated by passing a portion of the engine water through a submerged coil system in the clarifier influent channel when the engine circulating water temperature approached 200°.

The heat exchanger units are provided with both natural and digester gas supply and with individual metering facilities.

Boiler water temperatures have been controlled at about 190° and the blending water for the exchanger tubes at about 130°. With these temperatures it has been possible to maintain a 6° to 8° sludge temperature differential through the heat exchanger. Digester temperatures are maintained at slightly above 90°.

Practically no difficulty has been experienced from clogging or overheating of the circulating sludge pumps. There have been no stoppages within the tube system of the exchanger.

After approximately 15 months of operation the results have been more than gratifying. Digester temperatures have been maintained above 90° and at a more uniform temperature. Circulation of sludge in the digester has been maintained at the rate of 2.5 hr on each 8-hr working shift. This provides a complete turnover of the digester in about 2.6 days. Under this system the circulation time may automatically be extended if the digester requires more heat. During this 15-month period the No. 1 heating unit has consumed an average of 8,300 cu ft of digester gas and 1,100 cu ft of natural gas per day to maintain the optimum temperature in the digester. In the No. 2 digester heater, where a portion of the heat needed for the sludge is supplied from the heat recovery system of the pump and generator engine exchanger, only an average of 1,700 cu ft of digester gas and 100 cu ft of natural gas has been used daily.

Gas Lifts

After considerable study, a gas circulating system was installed in one of the first-stage digesters early in October 1957. This provides the sewage plant with another use of sludge gas in the operation of the digesters. Not only is this Walker unit to increase gas production and provide a more uniform solids content within the entire digester, but also the operating and general results of this new venture will be of great interest for future expansion planning.

Aurora's Gas Production

Based on the 1956 daily average of 11,000 lb of primary sludge and 890 lb of secondary sludge removed for digestion, the digesters produced 48,210 cu ft of 629-Btu (gross) sludge gas. The daily use distribution of this quantity of sewer gas was as follows:

Digester and building heat	4,100 cf	8.5%
Pump engines 1 and 2	19,690 cf	40.9%
Generator engines 3 and 4	13,480 cf	28.0%
Incinerator	3,740 cf	7.7%
Heat-X units 1 and 2	4,040 cf	8.4%
Wasted	3,160 cf	6.5%
Total	48,210 cf	100.0%

The average daily sludge gas needed to maintain complete operation of the gas-utilizing equipment at Aurora totals 51,100 cu ft. The average daily deficiency of sewer gas was 2,890 cu ft, which was provided by the natural gas supply available at the plant. Therefore, in 1956 the digester system provided 94.2 per cent of the plant's total sludge gas requirements.

The utilization of 17,646,600 cu ft of sludge gas in 1956 had a value of $7,917 based on current natural gas rates. In breaking this down to a daily basis of 48,210 cu ft, this sludge gas was worth $21.70 to the plant in its operation. The sludge gas produced from digestion is definitely a by-product of sewage treatment that can help to increase efficiencies in sewage treatment and assist in reducing operating costs.

Seattle, Wash.

now has before it, a $164 million plan for abating the pollution of Lake Washington and Puget Sound. The plan envisages three stages—1960-70, $83 million for facilities both east of Lake Washington and north and south of Seattle along the Sound—1970-80, enlargement of facilities at a cost of $35 million—1980-90, further enlargement of all facilities at a cost of $45 million.

The report was prepared by Brown and Caldwell, Cons. Engrs. of San Francisco, who also presented a plan for $145 million expenditure for storm drain requirements outside Seattle. The treatment plant will include preaeration screening, grit removal, sedimentation and sludge disgestion. The effluent will be discharged 150 ft deep and 3700 ft out in Puget Sound; digested sludge will be pumped 4000 ft into the sound and discharged at a depth of 400 ft.

Code and Seal for Plastic Pipe, and Fittings

The National Sanitation Foundation Testing Laboratory, Inc., Ann Arbor, Mich., has released its listing of manufacturers receiving the seal of approval on their plastic products.

The listing is based on a three-year study of the suitability of plastic pipe for potable water supply use and subsequent testing of plastic pipe, fittings and materials.

Manufacturers have agreed to use the following code system for identification of materials in their products:

P—Polyethylene
PVC—Polyvinyl Chloride
RMP—Rubber Modified Polystyrene
PCeC—Polyvinylidene Chloride
CE—Cellulose Ester
ABS—Acrylonitrile - butadiene - styrene Copolymer
AS—Acrylonitrile Styrene Copolymer

What makes you think I know who swiped your hot cookies, Lady?

Detroit meeting was marked by extensive technical program and new . . .

FSIWA Activities *and Actions*

EDITOR'S NOTE: This short report covers the principal Board actions and business activities of the 1958 FSIWA meeting. Elsewhere in this issue is a report and reviews of some of the papers presented. Those papers not included in that report will be reviewed in the January 1959 Number, except that papers presented at the Industrial Waste sessions will be reviewed in the January Number of *Industrial Wastes* magazine.

■ ACTIONS, of far reaching import, by the Federation Board of Control were but a part of the 31st annual meeting. Probably the most important single Board action was that of rasing the annual dues from $5 to $8 per year, effective Jan. 1, 1960; that action came after the close of the technical sessions in Detroit.

Technical Sessions

More hours were devoted to technical sessions (including inspection trips) than in any previous meeting. Except for Monday morning and afternoon, the 1349 registrants had a choice of two sessions for every period through Thursday morning. Three sessions were devoted to industrial wastes, and two to research (one was a symposium on syndets). Next year's program, already outlined, contemplates a technical session opposite the inspection trips of which there will be alternates.

New Officers

Elected to serve for the ensuing year were:

President: Dr. W. D. Hatfield, Consultant, Decatur, Ill.

Vice President: Mark D. Hollis, Chief Engineer, U. S. Public Health Service, Washington, D. C.

Treasurer: Arthur H. Niles, Supt., Sewage Treatment Works, Toledo, Ohio.

Treasurer Emeritus: W. W. DeBerrard, Dep. Dir., Water Dept., Chicago, Ill.

NEW OFFICERS elected to serve in 1959 include Dr. W. D. Hatfield, Decatur, Ill., President; Mark D. Hollis, Washington, D. C., Vice President. SPECIAL HONORS to W. W. DeBerrard, Chicago, Ill. for his long service as Treasurer; and to Dr. W. F. Mohlman, Chicago, Ill. for his long service as Editor and later as Advisory Editor of the Federation Journal.

Exec. Secy.-Editor: Dr. Ralph E. Fuhrman, Washington, D. C.

Director at Large: Dr. Clair N. Sawyer, Associate, Metcalf & Eddy, Consulting Engineers, Boston, Mass.

Honors and Awards

W. W. DeBerrard retired as Treasurer after continuous service in that position since the inception of the Federation; he was honored by being named Treasurer Emeritus; he was also honored by the presentation of a special citation at the annual banquet.

Also specially honored at the annual banquet was *Dr. Floyd W. Mohlman,* retired Director of Laboratories of the Chicago Sanitary District. Dr. Mohlman who was the first Editor of the Federation Journal, and has been Advisory Editor since 1941 was honored with a special scroll and a silver bowl, as well as a citation from the German Sewage Works Assn.

HONORARY MEMBERSHIP was granted to: *E. Sherman Chase,* with this citation: "A graduate of the Mass. Inst. of Tech. and for the year following his graduation he was on the faculty of Worcester Polytechnic Institute. His service includes Supt. of the Reading, Pa. Sewage Disposal Plant, Assistant Sanitary Engineer of the New York State Dept. of Health and Sanitary Engineer for Metcalf and Eddy. He served the Federation as President in 1952-53. He is a member of the Federation Quarter Century Operators' Club and his service and attainments were recognized by the Emerson Award in 1956."

HONORARY MEMBERSHIP was also granted to: *George J. Schroepfer,* with this citation: "A graduate from the School of Engineering, University of Minnesota in 1928, he became Assistant Chief Engineer of the Minneapolis-St. Paul Metropolitan District Commission and later advanced to the Chief Engineer's position. Concurrent with this work he was a part time lecturer at the University of Minnesota. In 1945 he became a full time Professor of Sanitary Engineering at the University of Minnesota where he directs research, lectures to sanitary engineering classes and inspires new sanitary engineering students. His service to the Central

States Sewage and Industrial Wastes Assn., as well as the Federation, include the Bedell and Hatfield Awards and the Eddy Award in 1956. As third President of the Federation, he is now the oldest living Past President from the standpoint of service."

The HARRISON PRESCOTT EDDY MEDAL for an outstanding contribution in research was awarded to *W. E. Budd* and *George F. Lambeth* for their article on "High Purity Oxygen in Biological Sewage Treatment" published in the March 1957 Number of the Federation Journal.

The GEORGE BRADLEY GASCOIGNE AWARD for an outstanding contribution in plant operation was presented to *Dean M. Taylor,* for his article on "Sludge Conditioning and Filtration at Cincinnati's Little Miami Sewage Works," published in the December 1957 number of the Federation Journal.

The INDUSTRIAL WASTES AWARD for an outstanding contribution in industrial waste control was presented to *H. W. Bialkowsky* and *P. S. Billington,* for their article on "Pilot Studies to Predict Effects of Waste on Receiving Waters," published in the May 1957 number of the Federation Journal.

The CHARLES ALVIN EMERSON AWARD was presented to: *"Dr. Gail P. Edwards* in recognition of his many and important contributions to the science of sewage treatment through his activity and leadership as member, vice-chairman, and chairman of the Standard Methods Committee and as a member of the Joint Editorial Board of Standard Methods for the Examination of Water, Sewage, and Industrial Wastes and of his many other services in advancing the basic purposes of the Federation."

Board Actions

The Board of Control held two meetings. It received and approved committee reports from the several constitutional committees and various other standing committees as well as interim committee reports.

Among the specific actions of the Board were several of wide interest. Most important of these actions were:

1. Raised Federation dues for active members from $5 to $8 per year effective Jan. 1, 1960. Corporate dues will be increased to $15 annually and non-member subscriptions to the Journal will be increased from $7 to $10 a year. Single copies of the Journal will sell at $1.25 each.
2. Adopted a deficit budget for 1959. Reserve funds to the amount of $13,700 will be used to offset the deficit. Increases in the cost of Journel publication and central office operation make necessary this deficit financing.
3. Chose Seattle, Wash. as the site of the 1963 Annual Convention.
4. Resolved that the Joint Committee for the Advancement of Sanitary Engineering should be discontinued and that its functions and objectives should be assumed by the American Sanitary Engineering Inter-Society Board, Inc.
5. Voted to approve the change in Constitution of the Central States Sewage & Industrial Wastes Assn. whereby the area to be served by this association will consist only of the States of Illinois, Wisconsin and Minnesota.

Voted to accept the petition of the Indiana Sewage & Industrial Wastes Assn. to become a member of the Federation, effective Nov. 1, 1958.

6. Changed the name of the Operators' Qualification Committee to the Committee on Personnel Advancement.
7. Resolved that the Federation fully endorse the principles of the Federal Water Pollution Control Act, Public Law 660, 84th Congress, and the cooperative Local-State-Federal Program it supports and that the Federation also endorses amending Sect. 6 of said act to provide additional stimulus and more effective means of reducing the backlog of pollution abatement need.
8. Recognized that there is a distinct need for consideration of a change in the name of the Federation and voted to "appoint a special committee to secure additional names and suggestions and to prepare a report and recommendations for the consideration and action of the Board at its meeting in October 1959."

HONORARY MEMBERSHIP was conferred on E. Sherman Chase, Boston, Mass. and on George T. Schroepfer, Minneapolis, Minn.

Luncheon Speakers

Two luncheons were held during the meeting; the annual Federation luncheon on Tues., Oct. 7 and an Industrial Waste Luncheon on Wed., Oct. 8. At the former, *Dr. Robert W. Hartwell,* Gen. Mgr., Power Reactor Development Co., Detroit, Mich., spoke on "The Enrico Fermi Atomic Power Plant."

Pointing out that our economy demands development of nuclear fuels, Dr. Hartwell described the 100,000 kw breeder reactor at Monroe, Mich., and explained the principle of breeder fission. Since there will be no lake water for cooling purposes in the reactor area, there will be no radioactive wastes at this plant. All wastes, and the spent fuel will be shipped, either to Hanford, Wash., or to Savannah, Ga. There will be some low level wastes from the laboratory, but these will be monitored and only wastes of less than 1/10 permissible strength will be released. Ventilation to the atmosphere will also be monitored to keep it with the 1/10 permissible discharge limit.

At the Industrial Waste Luncheon, *Dr. W. H. Schuette,* Vice President of the Dow Chemical Co., and general manager of its Midland, Mich. Division, said that "an aggressive joint effort by industry and government agencies is the key to a successful solution of the problem of the nation's dwindling water resources." Dr. Schuette said the nation's expanding population and its expanding industrial activity will mean continually increasing pressure on a fixed amount of water resources. This will translate quickly into increased pressure on industry and on the public regulatory agencies; industry and these public agencies are stewards, jointly bearing the burden of working together to achieve a solution, with no room for failure.

"The problems of water conservation will become increasingly acute in the future. Further progress will depend on the rate of development of more enlightened awareness of the problem on the part of both industry and the public agencies."

Dear Bill: how is your planning?

"The trouble with most of us," said a well known water works friend of ours, "is that we plan only for the short range on a catch-as-catch-can basis. My work never became easy to me until I learned long range planning. Its importance was apparent the first month thereafter.

"With it I've had more time for leisurely handling of day-to-day chores; my work has been made easier, chances for mistakes and costly errors have been reduced and my work has become a pleasure instead of a continuing headache!"

What was his formula? He didn't have a formula but he had some experience-tested ideas to suggest. I have talked the problem over with a number of other men well known for their success at developing and using long range planning. The many suggestions received boil down to these basic ideas.

1. "Set aside a definite time for long range planning." Most long range plans fail because they are haphazard affairs developed in spare moments. Long range planning is too important to be treated as an "extra" in the day's work. Pick a definite period of time, free from every other outside activity, for long range planning work. Without setting this period, the task not only becomes most distasteful but certainly unproductive.

2. "Do it at the naturally opportune times." Picking such periods not only provides more leisure for good long range planning but generally a wealth of data and information with which to work. Suggested are such times as the beginning of the year, when new projects are being programmed, when lulls occur in the regular business routine and during intervals when others whose help we may need are free to work with you.

3. "Start planning when you have assembled all of the needed data and facts concerned with the project." No good long range planning has ever developed on an "off the cuff" basis. Whenever we attempt to work out such planning and at the same time expend effort in assembling such necessary tools with which to do the job our thinking is seldom left free for programming and idea development—it's too busy marshalling details better done beforehand or left to others.

4. Follow a detailed and concise plan rather than leaping from stone to stone as each makes itself apparent in our effort. "Long range planning is like building a structure of any kind, and no contractor would attempt such a building effort without a blueprint." A good well-drawn up blueprint of the long range plan is just as important no matter what business chore is involved. It can mean the difference between a job well done and one so devoid of effort we had better have gone fishing instead!

5. Make certain your long range planning and thinking is started only when you can be assured of uninterrupted time available to you in sufficient quantity to finish the project. Long range planning takes a lot of concentration and memory activity to be worthwhile. No one is capable of such planning when his thinking and programming processes are constantly interrupted; the human mind simply does not possess such capability.

6. Have adequate tools at hand with which to do the job and a comfortable working atmoshere; both are of vital importance in long range planing.

7. Develop a pre-conceived method, of which the foregoing are of course a part. If method and detail have all been worked out before undertaking any kind of planning, one can always be assured of a mind and body more relaxed and free to develop positive thinking. Otherwise the half-hearted results which follow are enough to discourage any man from long range planning of any kind in the future.

8. Make certain that a good planning method or guide has been set up beforehand; this not only assures our thinking will be kept on the right track but helps to marshall details in their proper place and perspective.

What should such a planning method or guide contain? Here's a few points:

a) Set down in writing exactly the goal sought and the area to be covered.

b) Be sure the purpose or goals are set before you start. When one knows where he is heading it's a lot easier to arrive at the destination.

c) Be sure co-operation of others needed in the project is available and that the help of such personnel can be assured for the specific period and time when the long range planning is to be done.

d) Set up all the necessary facilities ahead of time.

e) Where possible work out all procedure methods which are to be followed so that not only can they be used by yourself but as an aid to others who will participate in developing the particular long range plan.

f) If costs are a factor estimate them ahead of time and work within those costs. Failure to do this can result in coming up against a 'dead-end' for this reason or creating a bill which will discourage any possible good long range planning in the future.

9. Set up a definite schedule of not only what is hoped to be accomplished but the detailed steps in the long range programming effort itself. Such a pre-drawn schedule will be of great assistance in using the talents of other individuals without waste to them.

10. Set up an alternative plan to the one developed just in case something goes wrong with the primary plan. In nearly every instance, after the sought for program is developed there will remain over a large number of very worthwhile ideas or projects. Assembling them into an alternative plan not only makes certain that they will not be lost but often develops profitable procedures for future use which otherwise would be discarded or neglected.

Yours,

Jack

CHLORINATION GUIDE

This second of a series of six articles on chlorination practices is devoted to . . .

Chlorination of Wastewater

by EDMUND J. LAUBUSCH, Sanitary Engineer
The Chlorine Institute, Inc.*, New York, N. Y.

AUTHOR'S NOTE: The purpose of this series of six articles is to review briefly the fundamental principles of chlorination processes, especially as they relate to conventional water and waste treatment practices; to point out some of the principal hazards and flagrant abuses that are associated with chlorine use, and various means by which these can be minimized or corrected; and, to delineate, in a practical way, safe and effective handling techniques using equipment evolved from the cautious but rapid advancement of the science and art of chlorination.

In Part I** of this series various principles fundamental to chlorination processes were reviewed with especial reference to conventional water treatment practices. As was indicated, many of these also apply to the chlorination of sewage and other wastes for disinfection and numerous other purposes.

In this part of the series several of the important applications are summarized and the means by which various of these treatment objectives are accomplished are considered. Discussion of equipment methodology and dosage control common to other sanitary applications is covered in other parts of this series.

■ THE YEAR 1957 marked the 50th anniversary of the first domestic application of sewage chlorination on a plant scale at Red Bank, N. J. As in the case of water treatment technology, impetus to its adoption and development, principally for disinfection of polluted wastes and for odor control, came with the commercial availability of compressed chlorine gas in 1909, and of proprietary chlorine feed equipment in 1912-1913.

The use of chlorine for purposes other than waste disinfection and odor control developed only many years later. While its use for the former still constitutes its most important application, as an adjunct to primary and secondary waste treatment processes the benefits of chlorine are becoming increasingly apparent (See Fig. I-1 in Part I).

Although progress in the use of chlorine at sanitary and industrial waste treatment facilities has been steady (see Figs. II-1, II-2), the development pattern in not nearly comparable with that pertaining to water treatment. Now that there is strong public sentiment in favor of water resources conservation and pollution abatement, established and new uses of chlorine may be expected to become more widespread.

*The Institute and its members make no guarantee of results and assume no liability, joint or severally, in connection with the information herein contained or the safety suggestions herein made.

**_Water & Sewage Works_, Vol. 105, p. 411, Oct., 1958.

Chlorination Theory

The initial reactions that occur when chlorine is added to sewage or industrial wastes may be considered to be essentially the same as those that occur when chlorine is added to water. (See Part I for a more detailed discussion of this subject.) If pH levels are below 3.0 chlorine may be present momentarily in the molecular state. At normal pH levels encountered, however, it exists first as free available chlorine ($HOCl$, OCl^-) and, subsequently, in various combined forms. As in water, but to a much greater degree, free chlorine reacts immediately with a variety of oxidizable and chlorine-absorbing solids and gases in sewage and other wastes.

The amount of chlorine required to carry oxidation and chloro-addition reactions to equilibrium at any given time interval depends on the concentration of the oxidizable and chlorine-absorbing components present. Until that time is reached which is necessary to carry all such reactions to completion, the amount of chlorine consumed will increase with time. Beyond this point chlorine will exist almost entirely in the free available form and will not be consumed.

The intensity with which chlorine enters chemical reactions is measured by its oxidation potential.

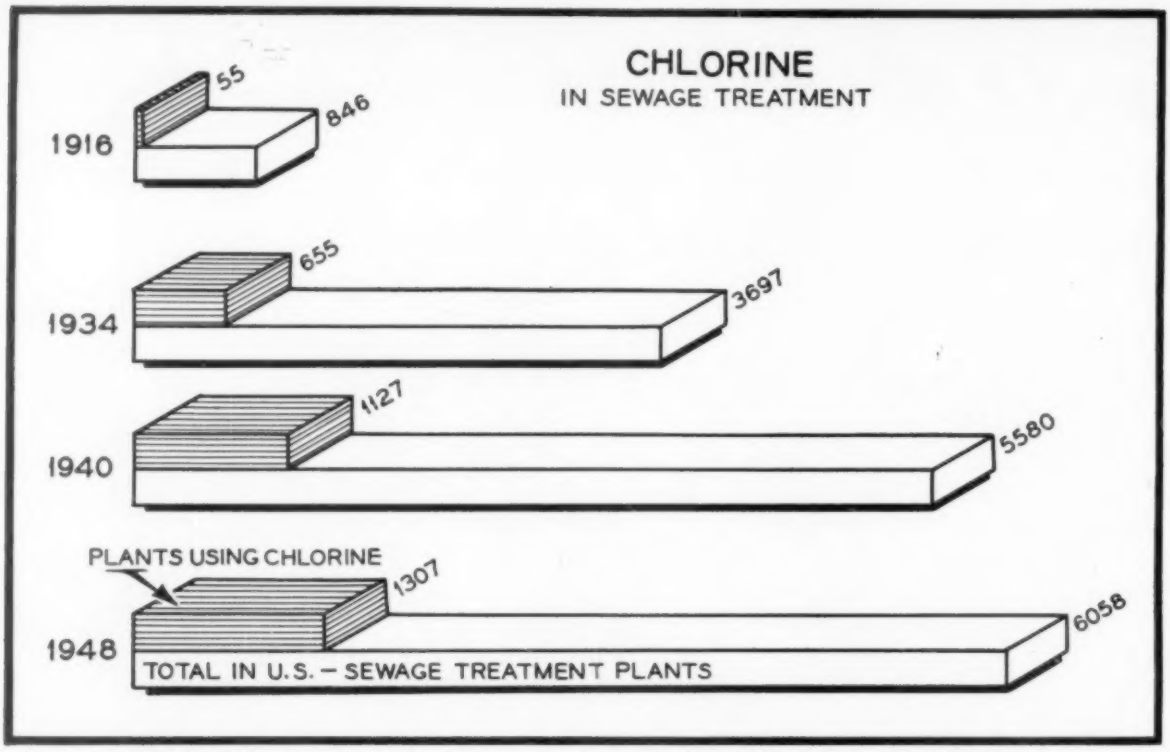


FIG. II—1. DEVELOPMENT of the use of chlorine in sewage treatment in the United States: 1916-1948.[4 5]

Chloramines formed by the reaction of chlorine and ammonia, and organic chloramines formed by the reaction of chlorine with complex, nitrogen-containing amino acid and protein compounds, have a lower oxidation potential than free chlorine. They are, however, still available for chemical reactions and for disinfection.

Waste Water Constituents

Among the important variable constituents of sewage and industrial wastes that affect chlorination processes are:

Alkalinity
Dissolved gases (including ammonia)
Organic substances (settleable, non-settleable and soluble)
Oxygen demand
Bacteria and other organisms

Alkalinity: The activity of chlorine dissolved in sewage is dependent on the pH. An increase in alkalinity results in the acceleration, and a decrease results in the reduction of both the rate and extent of these reactions. The concentration and form (a function of pH) in which chlorine exists, as well as the concentration and form of oxidizable substances, control the mechanism of the reactions and the end products formed. With some compounds, oxidation reactions proceed only slowly even though the pH, temperature, concentration of reacting substances, and other influencing factors are at optimum levels; in such cases, an appreciable amount of time must be provided to reach equilibrium.

The addition of chlorine to waste water reduces the alkalinity by from 0.7 mg/L to 1.4 mg/L per part of chlorine, depending on the degree of ionization of the hypochlorous acid and the manner in which the chlorine is consumed.

Dissolved Gases: Chlorine reacts with dissolved hydrogen sulfide, a decomposition product of unstable organic components of sanitary wastes. This gas exerts a chlorine demand and reduces the oxidation potential of chlorine.

As noted previously, chloramines formed by the reaction of chlorine and ammonia are lower than free chlorine forms in oxidizing capacity. Similarly, many organic chloramines and chlorine substitutes or derivations of organic nitrogenous compounds do possess disinfecting potentials, but they are of much lower magnitude than those of free chlorine and mono- or dichloramine forms.

Organic Substances: Unstable organic substances normal to sewage and other wastes comprise the bulk of settleable and (especially) non-settleable suspended solids. The removal of settleable organic solids along with stable inorganic materials (sand, grit, etc.) usually presents no special operational problems although they do exert a substantial chlorine demand until separation is accomplished. The removal of colloidal solids, particularly those that are organic, presents treatment complications. Like proteins and amino acids, many of these exhibit a distinct affinity to chlorine and exert a very substantial chlorine demand in the process of chlorine absorption and formation of chlorine-addition products.

Oxygen Demand: The increased oxidation potential of chlorinated sewage and industrial wastes reduces the biological oxygen demand and the putrescibility of the waste. An average 5-day BOD reduction of about 2 mg/L occurs for each part of chlorine added to domestic sewage.

It has been estimated that when sufficient chlorine is added to sewage to carry the oxidation reaction to an equilibrium in a 10-min reaction period, the non-settleable solids (principally unstable organics, but also

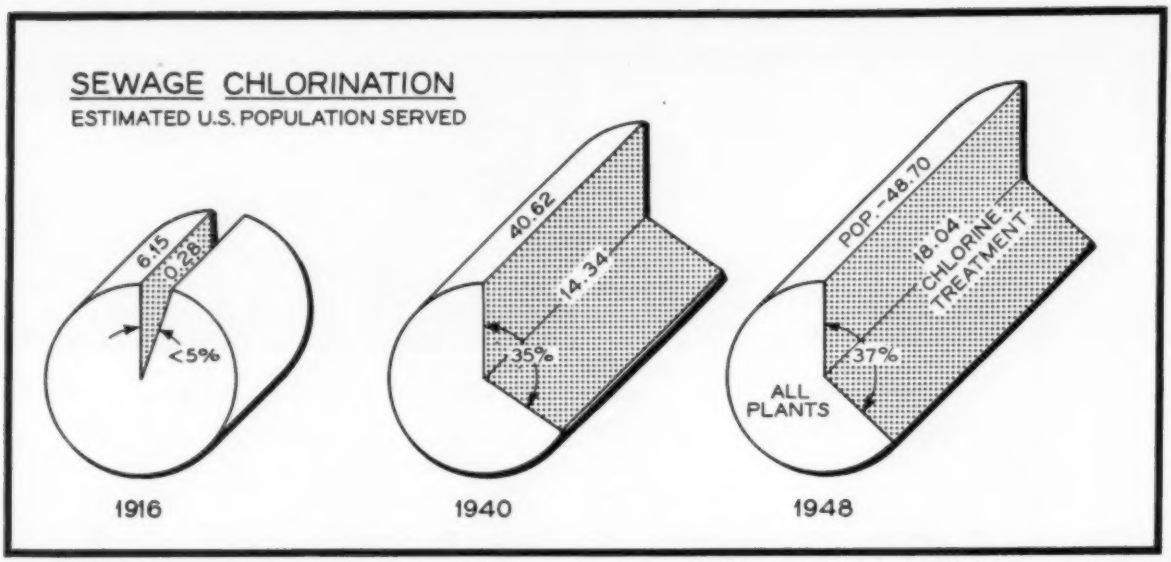


FIG. II—2. U. S. POPULATION (in millions) served by sewage treatment facilities with (shaded) and without chlorine treatment: 1916-1948.[4] [5]

including some finely divided inorganics) consume about 50 per cent of the chlorine added, and the settleable and soluble substances (unstable organics, stable inorganics) each consume about 25 per cent. Only a negligible amount is consumed by bacterial cells and higher biological forms.[1]

Bacteria and Other Organisms: The biological composition of sewage is extremely variable in both types and numbers. Moreover, some industrial wastes may be heavily contaminated with bacteria and other organisms, while others may be completely devoid of life. Every waste must be considered separately, therefore, in order to establish the chlorine requirements to effect complete or partial disinfection.

Chlorine Disinfection

The destruction of bacteria and other organisms is the principal use of chlorine in waste treatment. The extent to which biological destruction or attenuation occurs depends on such factors as the amount and form of available chlorine, contact time and temperature, and the composition of the waste being treated, all in terms of the various factors previously highlighted.

Chlorine Requirements: To effect bacteria kill it is not absolutely essential to apply a chlorine dose sufficient to produce a measurable residual. Reductions in bacterial concentration can be and are effected through marginal chlorination, the amount varying with the proportion of the chlorine demand satisfied. Obviously, this is subject to wide variations and depends largely on the character and strength of the waste being treated.

Estimated chlorine requirements for disinfecting normal sanitary sewage are listed in Table II.

Chemical reducing substances common to all wastes in varying amounts may react with chloride to form compounds having little or no bactericidal capacity. The formation of chloramines by the action of chlorine on nitrogenous constituents of wastes renders these constituents unsuitable as food sources; moreover, as already noted, they do possess definite disinfecting power. In sewage treatment, in fact, free residual chlorination is rarely practiced.

Irrespective of the kind or amount of available chlorine, that which does not penetrate dense suspended solids is ineffective in the destruction of bacteria and other organisms encased by these solids. Waste effluents containing substantial amounts of suspended solids that are discharged into water bodies may cause serious aftergrowths due to the release of imbedded bacteria by action of hydraulic turbulence that offtimes prevails. Furthermore, some biological species that are relatively unaffected by chlorine dosages typically encountered in waste treatment practices may reproduce prolifically in the absence of large numbers of metabolically-competitive, chlorine-susceptible forms.

The effect of temperature on the bactericidal action of chlorine is considered negligible within normal temperature limits. A major increase usually will increase the bactericidal effect proportionately. Where pH levels in excess of 8.5 are encountered, the bactericidal efficiency of chlorine is markedly impaired.

In employing chlorine in waste

Table II

Estimated Chlorine Required for Disinfecting Normal Sanitary Sewage

Treatment	Ten-State Standards[2] mg/l Chlorine	FSIWA[1] mg/l Chlorine
Pre-chlorination (mechanically cleaned tanks)	20—25	—
Raw Sewage	—	6—12 (fresh) 12—25 (septic)
Primary Effluent	20	—
Trickling Filter Effluent	15	3—10
Activated Sludge Effluent	8	2—8
Sand Filter Effluent	6	1—5

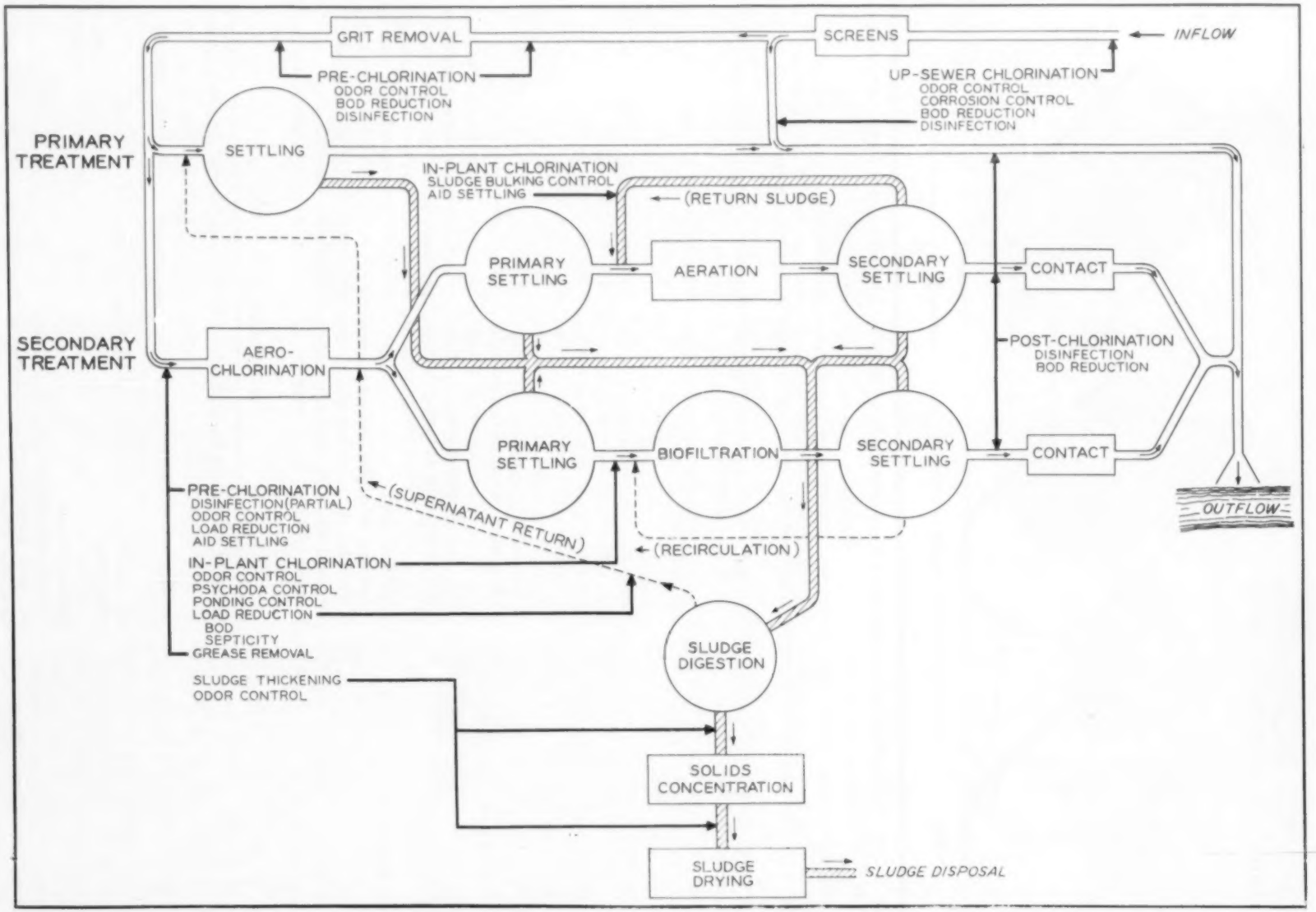


FIG. II—3. APPLICATIONS of chlorine in sewage treatment processes.

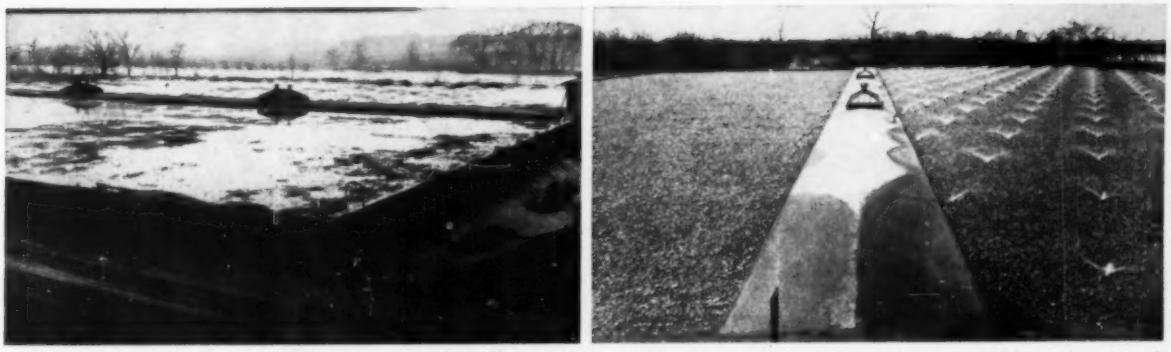


FIG. II—4. PONDING of trickling filters can be alleviated by chlorine treatment. These before and after photographs at Elgin, Ill. shows effect of 3000 lb of chlorine per acre applied over a 25 day period.

treatment processes, care must be exercised to select the point(s) of application and dosages in such a manner as to accomplish the objective as efficiently as possible without interference to the action of saprophytic organisms essential to aerobic or anaerobic purification processes.

Point(s) of Application: Flexibility in operation should be provided so that chlorine can be applied wherever it can best accomplish the desired objective. When that objective is disinfection primarily, *pre-* and/or *post-chlorination* usually is employed. *Up-sewer* chlorination (i.e., ahead of the treatment plant) should be employed for disinfection only in those instances where subsequent treatment is limited to screening. It is inefficient because the chlorine demand is great and the chlorine available can not fully penetrate the bacteria-laden solids. (As will be noted later, however, up-sewer chlorination frequently is applicable for many purposes other than disinfection.)

When secondary waste treatment is provided, *post-chlorination* is practiced where disinfection is indicated. Chlorine is applied at a contact tank, preceding the effluent discharge, or at the influent of the final clarifier. The latter is increasingly employed except where contra-indicated by activated sludge and biological filter recirculation practices. *Pre-chlorination* in dosages necessary to effect disinfection also is contra-indicated where subsequent biological processes are involved. Lesser amounts of chlorine for other purposes, however, can be applied throughout the treatment plant as later discussed.

When only primary treatment is provided, limited reductions in bacterial density are accomplished and disinfection often is required by local authorities. Either or both pre- and post-chlorination may be employed; split chlorination practices are becoming increasingly popular. Applied at one or more points in the interceptor, or to raw or screened sewage ahead of the settling units, maximum contact is provided. Moreover, though disinfection is the primary objective, other benefits may accrue such as odor control, septicity control and improved settling.

Terminal application alone is satisfactory but usually is less desirable since a special tank or other means of adequate contact with chlorine usually must be provided; also, the chlorine demand actually may be greater than that of the raw sewage if the waste is stale or putrescing.

Continuity of Disinfection: The basic criterion used by most authorities in establishing the need for disinfection is the effect of the discharged wastes on the receiving water body and its subsequent uses. Instances where it is required might include those numerous facilities in close proximity to public water supply intakes, bathing, other recreational and shellfish propogation areas, or where crop irrigation or dairy cattle herd pastures are involved. Obviously, then, requirements will vary from place to place as well as at any time for a given facility. Disinfection is practiced continuously, intermittently, or not at all, depending on local considerations and subject to the requirements[3] of the appropriate regulatory authority involved.

Residual Requirements: From the foregoing discussion it is apparent that the considerable variations in the chemical and bacteriological character of wastes, and in disinfection objectives, preclude the establishment of rigid, uniform chlorine residual requirements. The value of maintaining a fixed chlorine residual is based principally on local demonstration of the effect of such practices on desired bacterial kills, and conformance to requirements relative to the quality of the plant effluent or of the receiving water at any downstream point. More than 30 states have no official position relative to the maintenance of a fixed chlorine residual of waste effluents although an equal number have adopted the "Ten-State Standards"[2] recommendation that chlorination equipment should have sufficient capacity to be capable of producing a residual of 2.0 mg/L in the final effluent. As in water works practice, the only positive means of establishing the effectiveness of sewage disinfection is by measuring the bacterial population after treatment and at the point of water re-use.

Other Chlorine Uses

While the use of chlorine as a disinfectant in waste treatment constitutes its most important application, for odor control and as an adjunct to primary and secondary treatment processes the benefits are manifold (see Fig. II-3).

Odor Control: Most sanitary wastes are potential sources of odors because they present an ideal environment for prolific bacterial metabolism and subsequent putrefaction (anaerobic) of organic waste solids. The composition of sewage and industrial wastes often is such that chemical treatment is indicated to supplement other conventional treatment practices. Chlorine, being easy to apply and quick-acting, is one of the more important chemicals used for control of odors,

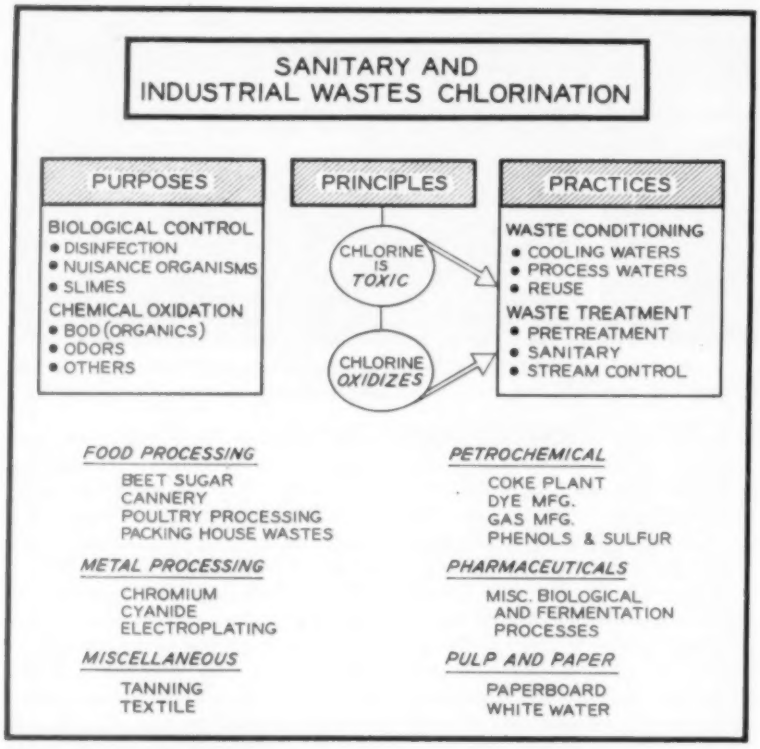


FIG. II—5. APPLICATIONS of chlorine in sewage and industrial wastes treatment for resources conservation and pollution abatement.

particularly that esthetically objectionable and economically important product of anaerobic decomposition, hydrogen sulfide.

In theory, about 2 parts by weight of chlorine are required to precipitate sulfur for each part by weight of sulfide as H_2S; and, about 8 parts by weight are required to oxidize it to sulfate. These reactions take place at pH 5 to 9, but the first occurs optimally at the lower pH level and the second, at the higher level. Because of the effect of other chlorine-demanding substances, considerably more chlorine actually may be needed to effect these reactions.

Corrosion Control: Concrete and metal sewage systems conveying wastes having in excess of about 1 mg/L hydrogen sulfide deteriorate, especially where the temperature is high and sluggish flows at low pH prevail. These conditions also enhance accelerated growth of slime-ensheathed, sulfate-reducing organisms that produce additional sulfide, a portion of which is absorbed by moisture and grease above the liquid surface and is subsequently oxidized into sulfuric acid.

Sub-residual, up-sewer chlorination (usually at somewhat greater dosages than that required for odor control only) reduces H_2S concentration to an amount which will not be vaporized. Higher concentrations of chlorine are indicated for the destruction of slimes.

BOD Reduction: It has been amply demonstrated that chlorine will reduce the biological oxygen demand of a waste within certain reasonably well defined limits — by 15 to 30 per cent. The practice is not advocated as a substitute for properly designed and operated treatment processes. It is recommended, however, for reducing the BOD load on various unit processes, for minimizing the effect of such overloading caused by unusual flows, the presence of industrial wastes, digester supernatant or activated sludge return to inflow, and for other purposes.

BOD reduction usually is effected where up-sewer chlorination is practiced for odor control, pre-chlorination for disinfection or odor control, or wherever else chlorine is applied for any purpose ahead of or within the treatment plant. While free residual chlorination will effect as much as an 80 per cent BOD reduction in activated sludge effluents, these and other secondary treatment effluents seldom are chlorinated for the specific purpose of BOD reduction, except possibly where the units are grossly overloaded. Similarly, while free residual chlorination of raw sewage might effect as much as a 50 per cent BOD reduction, this treatment is impractical under usual circumstances, patrially because of the high concentration of ammonium compounds and other nitrogenous materials.

In practice a reduction of 5-day BOD of 15 to 30 per cent can be anticipated in the presence of 10-min chlorine residuals of 0.2 to 0.5 mg/L. Furthermore, significant additional overall BOD reduction is effected under any condition for which chlorine is employed.[1]

Biological Filter Operation: The utility of chlorine as an adjunct to trickling filter operation has been demonstrated widely. The release of odors over trickling filters associated with the treatment of septic sewage usually can be controlled by pre-chlorinating at the dosage chamber. Frequently to preclude septicization of the waste during primary treatment, chlorine applied after screening is indicated. To avoid interfering with the biological nature of the process only a portion of the chlorine demand should be satisfied — usually about 50 to 75 per cent — and there should be no residual chlorine at the filter.

In addition to this and other benefits of up-sewer and pre-chlorination already outlined, the psychoda fly nuisance especially associated with filter operation during warm weather offtimes is amendable to chlorine treatment. Various successful treatment regimens have been reported, but optimum treatment should be based on local experiences.

Filter ponding, due to the accumulation of excess solids that clog the interstices of the filter, sometimes can be alleviated by chlorine (see Fig. II-4). Intermittent, shock treatment of 5 to 10 mg/L residual at the filter nozzles during periods of low chlorine demand, or continuous chlorine application to produce a residual of 1 to 2 mg/L usually will be effective in loosening excess zoogleal material that can then be flushed from the filter. Where clogging has penetrated the bed deeply or otherwise is due to

the accumulation of insoluble mineral particulates, chlorine treatment usually is of little lasting or no benefit.

Sludge Bulking Control: Sludge bulking, manifested by poor settling of activated sludge in secondary clarifiers, sometimes can be eliminated with chlorine. In instances involving excessive overloading of treatment facilities, prechlorination of the plant influent often is beneficial. Where bulking of activated sludge is attributable to an abnormal concentration of filamentous fungi, the application of chlorine to return activated sludge at a point which allows 2 to 3 min contact before mixing with the sewage also may be of benefit.

The proper chlorine dosage is dependent on the sludge index and the amount of dry solids in, and the rate of, the return sludge. It appears that continuous chlorination yields results superior to those obtained by intermittent practice.

Miscellaneous: Among those other applications in which the utility of chlorine has been demonstrated are:

Grease Control—aero-chlorination preliminary to primary settling.

Sludge thickening—chlorine applied to waste activated sludge in thickening units.

Digester supernatant—chlorination preceding discharge to primary settling units, to reduce the load and minimize odors.

Digester sludge—chlorination prior to discharge to drying beds, for odor control.

Coagulation Aid—to improve the settleability of wastes, in conjunction with various chemical or biochemical processes.

Foam Control and Miscellaneous Plant Improvements—chlorine applied to accomplish a specific objective, or achieved incident to chlorine treatment for some other purpose.

Courtesy Wallace & Tiernan, Inc.

FIG. II—6. ALKALINE chlorine oxidation of cyanide waste from cadmium electro-plating operation. Foreground: Work being prepared for plating in cleaning tanks. Background (l. to r.): Collecting sumps (under grating), chlorinator, booster pumps, and plant water suction chambers. The reaction tank is not shown.

Industrial Wastes Chlorination

Biological and chemical wastes of increasing complexity are products of modern technology. Over the past quarter century, the utility of chlorine as a waste treatment chemical and disinfectant has been established (see Fig. II-5). Some wastes have such a high chlorine demand that other treatment methods are dictated for practical reasons. Similarly, certain other industrial wastes are unaffected by chlorine.

Of the chemical wastes for which chlorine treatment is commonly employed, cyanide-containing, metal-cleaning and electroplating wastes, and phenol-containing gas, coke or other petrochemical wastes, are the most outstanding. The presence of cyanides and phenols in untreated wastes discharged to surface waters imposes a potential public health hazard and often creates economic and esthetic problems of great magnitude. These chemicals can be readily oxidized by chlorine under certain, well-established conditions (see Fig. II-6). In the latter case, if the concentration is very high, phenol recovery preliminary to chlorine treatment may be indicated.

In the treatment or pretreatment of textile wastes there are many applications of chlorine. It is used as a coagulant aid, for bleaching, BOD reduction, septicity control, grease recovery and other incidental purposes. Each waste constitutes a special problem that requires thorough study on the suitability and means of chlorine application.

As an adjunct to conventional and modified biological treatment processes adaptable to food processing wastes, chlorine frequently is employed for BOD, odor and septicity control and for disinfection, where indicated.

The reuse of treated sewage and some industrial waste effluents and process waters is made possible by chlorine treatment. Chlorine serves as a disinfectant to prevent disease transmission, to control slimes, marine and other biological nuisance organisms, in addition to oxidizing objectionable waste products. Resources conservation and water pollution abatement are thereby enhanced—a factor of growing importance and necessity in this increasingly-competitive, technological era of modern times.

Acknowledgment

Figures illustrating typical biological and chemical effects of chlorine in the treatment of water and wastes were developed from a concept suggested by Harry A. Faber, formerly research chemist of The Chlorine Institute.

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(1) Federation of Sewage and Industrial Wastes Assn., Manual of Practice No. 4. "Chlorination of Sewage and Industrial Wastes," Washington, D. C. (1951).

(2) Upper Mississippi River Board of Public Health Engineers and Great Lakes Board of Public Health Engineers. "Standards for Sewage Works-Illinois, Indiana, Iowa, Michigan, Minnesota, Missouri, New York, Ohio, Pennsylvania, Wisconsin." (May 1952).

(3) Laubusch, Edmund J., "State Practices in Sewage Disinfection," *Sew. & Ind. Wastes,* 30:8 (Aug. 1958).

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Detroit meeting offers ten tehnical sessions beginning with subjects on . . .

Administration, Cost Reduction and Syndets

EDITOR'S NOTE: The FSIWA national meeting had the largest number of technical sessions ever offered at its annual meeting. The first day's activity was devoted to opening the meeting and discussing subjects of a general nature. Concurrent sessions were held on the second day including separate inspection trips to either the Detroit Sewage Works or the industrial waste treatment plants of the Ford Motor Company. This report concerns itself with the activities and abstracts of papers presented during the first two days.

K. S. Watson
President

R. E. Fuhrman
Exec. Sec. & Editor

■ THE 31ST ANNUAL MEETING of the Federation of Sewage and Industrial Wastes Associations was opened Monday morning with an address by Kenneth S. Watson, President of the Association.

President Watson stated that his job has made him more fully aware of the many challenges that are present today in this vast field. One of the most important problems currently facing the field is the lack of an overall effective public relations program. Better "sell" is needed. This may involve a study in semantics and similar studies necessary to advance the professional stature of the men in the field.

The Association must instigate and implement further research in the treatment of nuclear wastes and demonstrate its leadership in this field.

Ralph E. Fuhrman, Executive Secretary-Editor of the Association, stated that the Michigan Sewage and Industrial Wastes Assn. was the winner of the numerical membership increase prize with 146 new members. The Puerto Rico Assn. won the prize for the greatest percentage increase in membership.

■ INTERNATIONAL JOINT COMMISSION ACTIVITIES by Mr. Eugene W. Weber, substituting for the Hon. Douglas S. McKay, Chairman of the U. S. Section of the Commission.

The Commission consists of three representatives from each country (United States and Canada) and has jurisdiction over the 3000 miles of boundary water between the two countries.

The duty of the Commission is to approve or reject applications submitted by either country which pertain to projects that may raise, obstruct or divert water on or adjacent to the boundary, and to investigate and make recommendations on special problems upon request of either government.

The Commission has established the following priorities governing the uses of boundary waters: (1) Domestic and sanitary uses; (2) Navigation; and (3) Power and irrigation.

The history of the Commission shows that studies in water pollution were started well before World War I, but due to the war and the period following, no action was taken until 1946 when a second study was started. After three years of intensive study, the final recommendations were made to the respective governments. In 1950, the governments appointed supervisory boards to direct and supervise water pollution control activities. The basic rule designed to control water pollution stated that no effluent shall affect the use of boundary water for domestic, recreational and industrial purposes.

The Commission has conducted studies on air pollution. One concerning the smoke from those vessels plying the boundary waters was studied and recommendations for control were made to each government.

■ ONTARIO MOVES AHEAD ON WATER RESOURCES PROGRAMMING by Dr. A. E. Berry, Gen. Mgr., Ontario Water Resources Commission.

In 1955, a water supply and resources committee was appointed in Ontario. By 1956, the committee's recommended law was passed, establishing and organizing the Water Resources Commission. This Commission is authorized to control all water resources. Sewage under the law being considered as used water.

Since the Commission became effective in 1957, over 40 municipal projects have been developed, of which 10 are completed. The total estimated cost of these projects is $25 million. The other 30 projects are in various stages of construction or engineering.

When the regular agreement between a community and the Commission is arrived at, the various industries within that community are bound by such an agreement insofar as water supply and waste disposal is concerned. This is of particular concern since nearly 50 per cent of all industry in Canada is located in the Province of Ontario. Rapid run-off and low annual rainfall leaves some inland communities including the industries with an acute water problem when water use is not regulated.

In addition, the Commission can regulate water use and provide for the joint treatment of sewage for several communities. The Commission is also empowered to levy fines up to

$1,000 or six months in jail for those responsible for not correcting a polluting condition after receiving recommendations to do so from the Commission.

A state of complete and close cooperation exists between the Health Authority and the Commission.

The Commission can force the industry to treat its wastes although no financial assistance is provided to the industry by the Commission as is the practice for the municipality. Industry can make arrangements with the municipality for the treatment of its wastes. The community has the right to appeal the Commission's decisions through the Provincial courts, however, the Commission usually works with the community in the formulation of its decision affecting the community and this right is seldom exercised. Regarding repayment of monies loaned to the communities by the Commission for the construction of facilities, the community is authorized to raise money any way it desires — taxes, sewer charges, bond issues, etc.

General

■ EFFECTS OF STREAM IMPOUNDMENTS ON DISSOLVED OXYGEN RESOURCES by F. W. Kittrell.

Dams are responsible for D.O. depletion and should be considered a pollutional source similar to any domestic or industrial discharge. The downstream flows from dams may have oxygen levels below 5 mg/L before ever receiving any pollutional loadings. At Rockhill, S. C. the D.O. levels in the Catawba River have been 3.0 mg/L; at Boone Reservoir, Kingsport, Tenn., 1 to 2 mg/L; and on the Roanoke River, Va. below the Kerr Reservoir, 2 mg/L.

Storage reservoirs having high dams over 100 ft, large impoundment areas and low currents may retain water for periods up to a year. The discharge line or penstock intake is deep and water leaving the reservoir may be devoid of any D.O. If the penstock discharge and tailrace create turbulent water flow, D.O. may be restored to 8.0 mg/L or more.

Main stream reservoirs of dam height less than 100 ft are never responsible for total reduction in D.O. but are not capable of reaeration either.

Corrections for the undesirable effects of stream impoundment are suggested:

1. Provide multi-level penstock intakes so that water draw-off may be selective and possibly create mixing of the reservoir waters.

F. W. Kittrell
D.O. Depletion

D. M. Pierce
Opr. Certification

2. Install a weir which would require impounded water influent to pass near the surface before it can be discharged from the submerged intake.
3. Reaerate the reservoir using compressed air and applying at extreme depth.
4. Improve tailrace design to create turbulence in the discharge waterflow.
5. Create turbulence in other discharge devices used at impoundment reservoirs.
6. Recirculate by pumping impounded water from the hypolimnion to the epilimion, to destroy stratification and support continued mixing. This type operation is suggested for hydro-electric power stations since the cost of electric is at a minimum.

■ MANDATORY CERTIFICATION OF PLANT OPERATORS; VOLUNTARY LICENSING OF OPERATORS by Donald M. Pierce and G. Lowmeyer respectively.

In Michigan, the mandatory certification of plant operators was required by law in 1949. Prior to this time a voluntary licensing plan was in effect but to move ahead, the plan needed the authority and backing of the State Government. The objective of voluntary or mandatory licensing is to provide added benefits to the employer and the employee. Both must benefit.

The Michigan law requires all municipalities to hire licensed men. Licensed men must meet the experience, educational and personal qualifications and demonstrate their knowledge by written examination. The usual grandfathers clause was carried in the law but of the 65 licensed under this clause who are still on the job, only 10 have failed to pass the examination and 18 have declined even an attempt to pass the exams. The majority of the men applying for examination in Michigan at the present time are below the shift operator grade and have applied after meeting only the minimum experience and educational requirements. The plan has complete acceptance by most employees and employers.

Florida has a very enthusiastic operator's association which maintains a voluntary licensing plan. The plan is administered by the Bureau of Sanitary Engineering of the State Health Department. The Bureau maintains all files of the association, issues all certificates and distributes notices and correspondence to some 700 operator members and 100 associate members.

The operators maintain their short schools and correspondence courses through the Univ. of Florida. The training courses have been established since 1930 and are directed to supply the information and knowledge required to meet the licensing qualifications.

In Florida, the operators are united in support of a bill submitted to the legislature outlining the compulsory certification and licensing of plant operators in Florida.

■ SEWAGE TREATMENT NEED OF THE UNITED STATES by Gordon E. McCallum and John R. Thoman.

Half of the population of the United States living in areas that are serviced by municipal sewer systems have either inadequate sewage treatment facilities or no facilities at all. To correct this situation will require an expenditure of $1.8 billion.

Even though great strides have been made in building treatment plants during the last 12 years, the load from municipal sewers has increased five per cent during that time. One plant in three is inadequate for present needs, let alone sufficient to take care of the rapidly increasing United States population and other factors. One plant in seven of those existing today needs replacement, compared with one in 10 in 1950.

Expenditures for new sewage treatment plant construction must increase if we are to take care of the immediate needs and keep pace with our rapidly expanding population.

The $1.8 billion cost to eliminate the backlog of municipal sewage treatment needs represents only a part of what must be spent to conserve the Nation's water quality. Of the total cost, $1.4 billion dollars is needed for completely new treatment plants, and $321 million dollars for additions and enlargements. However, there is no allowance in this total for obsolescence, better treatment, increase in population and urbanization, or costs of plants in presently unsewered cities and towns. Almost 4,000 new plants are needed to serve 22 million persons, including 1,110 which are required to replace existing plants.

Mr. McCallum said that the larger cities are meeting current sewage treatment needs more adequately than smaller communities. Cities of less than 25,000 population, which comprise over 95 per cent of the sewered communities, have 35.1 per cent of the population connected to sewers, but they have 47.2 per cent of the dollar-cost of backlog needs.

The recent Rockefeller report on the national economy gives an estimated range of expenditure for water supply and disposal from $2.7 to $3.5 billion by 1967. This is about three times as much as was spent in 1957.

Treatment Cost Reduction Symposium

■ COST REDUCTION BY USE OF ADVANCE PRACTICES IN ACTIVATED SLUDGE AND SLUDGE DIGESTION by Richard H. Gould, Dir. Sewage Disposal, Dept. Public Works, New York, N. Y.

A better understanding of the basic requirements of the activated sludge process and the digestion of sludge have permitted advances in practice that justify reducing the size of aeration tanks by at least ½ and of digestion tanks by ⅔ of the standard requirements of many State Health Departments.

Advances in activated sludge treatment are based on the use of a short sewage-sludge contact period, the maintenance of a specific mass of activated sludge as determined by the load to be treated, its aeration at concentrations up to that of return sludge, and its dilution by the addition of sewage at one or more points before passing to the final tanks, so that the aeration tank effluent carries no more solids than can be handled by such tanks. The methods of Step Aeration, Biosorption, Contact Stabilization, and the Kraus Processes are cited as conforming to this general practice. Certain advantages and limitations were pointed out.

G. E. McCallum
U.S. Needs

R. H. Gould
Cost Reduction

The effort in advanced practice for sludge digestion is to secure substantial homogeneity in the contents of digestion tanks. It was pointed out that bottom deposits in areas of little or no current flow causes the build-up of sludge that can decrease tank gas output by as much as ⅔. Examples of some of the methods used to achieve homogeneity in tanks are the high velocity jets and multiple sludge outlets of the Nut Island plant in Boston, and the proprietary devices of the Dorr-Oliver Co., The Chicago Pump Co., The Pacific Flush Tank Co., and the Walker Process Co.

A suggestion was also made that State Health Departments become more aware of the advantages of the advanced methods, and urge a more reasonable expenditure of public funds to allow the use of these methods.

■ COST REDUCTION OF SEWAGE TREATMENT PLANT CONSTRUCTION by Alfred W. Sawyer, Partner, Hazen & Sawyer, Cons. Engrs., New York, N. Y.

Effective savings in the construction cost of sewage treatment plants are primarily a function of careful planning and design. In most respects, the cost is determined before the contractor moves on to the job.

The quantity and character of flows to be treated must be known and is of particular importance when industrial wastes are involved. Excessive flows from infiltration of storm drainage connections and unusual or toxic wastes from industry can do much to increase plant costs. The possibility of reducing or eliminating such flows should be studied.

The type and degree of treatment must be based on the stream's ability to receive the plant effluent without adverse effects. The point of discharge and periods of minimum stream flow are important in determining the degree of treatment required.

Careful selection of the plant site and the proper arrangement of units on the site can save money, particularly where foundations may be a problem. Design should recognize site conditions and the manner in which a contractor can make a reasonable approach to the problem of construction.

The designer must keep abreast of new developments and determine what can be applied to the case at hand. Most important of all, he must keep the design both simple and functional.

■ COST REDUCTION OF SEWAGE TREATMENT PLANT OPERATION by E. J. Beatty, Engr.-Mgr., Champaign-Urbana Sanitary District, Urbana, Ill.

Many operating costs are designed into plants due to lack of careful consideration during design. For instance, certain equipment requires more labor to keep it in proper operating condition while the use of proper portable equipment and tools further reduces labor costs. There is very little operation can do to control certain fixed costs such as power, other utilities, insurance costs and overhead items. Operation can control labor, depreciation and repair costs.

Health Departments should require plants to maintain adequate standby and portable pumping equipment. Manufacturers should list the original equipment manufacturer of component parts and the original manufacturers part number on the name plate of the unit.

Present day sewage treatment plants are equipped with expensive instruments. The cost for the upkeep and maintenance of this equipment must be evaluated. Smaller plants need an instrument maintenance man and his costs should be taken into consideration.

Synthetic Detergents Session

■ REMOVAL OF ABS BY SEWAGE TREATMENT by P. H. McGauhey and S. A. Klein.

The composition of domestic sewage has been altered due to the extensive household use of garbage grinders

and synthetic detergents. The alkabenzene sulfonates (ABS) appear in sewage in an average concentration between 5 to 10 mg/L. These syndets have been blamed for a number of sewage treatment problems but the authors conclude that these concentrations have no deleterious affect on the sewage treatment process.

Concentrations in the range of 25 to 50 mg/L of ABS create some reduction in solids in the activated sludge process but have no noticeable affect on trickling filters. The per cent removal of ABS in 2 hour settled sewage averaged above 3.0 in the three tests performed. The removal in filtered sewage averaged above 11.0 per cent in the same test.

Activated sludge treatment with 4 to 6 hrs of aeration will remove 50 per cent of ABS. By maintaining a solids concentration of from 5,000 to 6,000 mg/L in the aeration tank, an initial removal of 60 to 70 per cent could be obtained but not maintained.

For efficient removal, it is suggested that a foaming agent be added to the influent of the aeration tank and the ABS be stripped off the tank as foam and burned with sludge gas. This appears to be an effective way in which to remove ABS from the receiving stream.

■ Evaluation of Frothing in Sewage Treatment by L. B. Polkowski, G. A. Rohlich and J. R. Simpson.

Frothing in sewage treatment is the result of a combination of factors. In two tanks receiving the same sewage under the same conditions as measured by all laboratory and other means, one tank will foam and the other will not. Additional factors are still to be considered.

The factors considered were the surfactants present, the suspended solids content, the absence or presence of grease or fatty acids, the aeration rates and foam stabilizers such as adding raw sewage proportionately throughout the tank. It was noted that in general less froth occurred in the advanced stages of nitrification and that more froth existed at higher suspended solids concentrations.

The analytical methods for qualitative analysis of frothing conditions is scheduled as a report in itself. These analyses involve the evaluation of the persistency of the bubble and the average life expectancy of the bubble forming froth.

R. McKinney
ABS Metabolism

C. E. Renn
ABS Absorption

■ Biochemistry of ABS Metabolism by Ross E. McKinney and James E. Symons.

The structure of ABS can be divided into three component parts: the tetraproylene side chain, the benzene ring and the sulfonate group. The bacteriological literature indicates that bacteria should be able to metabolize each of the component parts except for a potential problem with the sulfonate group.

Experiments demonstrated the ability of common soil and water bacteria, which predominate in activated sludge, to utilize ABS as their sole source of organic matter. Some bacteria were found to live in the presence of organic matter and ABS. In other organisms, it was noted that the ABS stimulated the ultilization of organic matter.

Treatment by activated sludge showed that the basic component parts of the ABS molecule could be degraded by themselves but that ABS itself could not be degraded completely. This failure is caused by a quaternary carbon in the hydrocarbon side chain which blocks metabolism. Fundamental meabolism requires a hydrogen or hydrogen replaceable group on the quaternary carbon, rather than another carbon, to theoretically continue bacterial metabolism. Oxidation would stop at this point and any further metabolism would be limited to displacement of the blocked material from the cells and the normal substrate end product equilibrium. The ABS metabolism would cease and free ABS would remain in solution.

The quaternary carbon is believed to exist where the hydrocarbon side chain joins the benzene ring. This was reported by the Continental Oil Company which indicated that the average ABS structure took this form.

■ Absorption of Alkyl Benzene Sulfonate on Particulate Materials in Water by Charles E. Renn and Mary F. Barada.

All of our major surface waters are receiving varying quantities of alkyl benzene sulfonate and other synthetic detergent principles. Concentrations are very low except possibly in those areas undergoing severe drought.

Since the large part of removing organic pollutants from water supplies is accomplished by removing the suspended solids, a more general approach of observing two broad classes of surfaces was employed.

These consisted of those surfaces readily wetted by water and those not readily wetted by water but having an affinity for hydrocarbons. Exploration showed that petroleum oil emulsions, powdered paraffin, and activated carbon absorb the hydrocarbon branches of ABS and are more effective in taking ABS from water solutions. China clay, talc, diatomite, silica gel and precipitated calcium carbonate which attach to the water seeking bond of ABS are less effective.

Summary of Surfaces Evaluated

	lb. required to remove 1 lb. ABS
Hydrophilic	
China clay	573 to 1155
Talc	363
Diatomite	1490
Silica gel	1530
Calcium Carbonate	300 to 1000
Hydrophobic	
Petroleum Oil Emulsions	26 to 194
Powdered Paraffin	14,000
Activated carbon	
0.2 mg/L ABS conc.	120 to 220
2.0 mg/L ABS conc.	40 to 53

Higher concentrations of carbon remove larger quantities of ABS. The unit efficiency of activated carbon increases as the concentration of ABS increases.

Promising results were obtained using fine bubble aeration combined with activated carbon. This is a simple but unorthodox method of reducing the ABS concentration to where such methods as using activated carbon can be employed economically. This may make a good device for treating waste waters for industrial reuse. The 0.2 represents peak concentrations of ABS for heavily polluted rivers and the 2.0 represents the highest in the range of treated sewage effluent.

A joint meeting at Memphis, Tenn. heard AWWA and FSIWA national presidents discuss . . .

Public Recognition *and return for adequate service*

EDITOR'S NOTE: The meeting featured separate and joint sessions on water and used water treatment. Addresses by both the president of the AWWA and the FSIWA headed the program. Their talks are reported here.

Five papers concerning water works, four papers on sewage works, and two joint panel discussions on operation and details of design made up the technical program.

The joint session provided an opportunity for personnel of the water and sewage works fields to appraise the use and protection of our water resources on a mutual basis. Although competition exists, naturally, between operators in the two fields, the overall objectives remain the same. The discussions during the meeting brought out these facts, therefore, this report dwells mainly on the common theme of adequate rates (or return) and recognition for adequate service.

L. S. Finch
Pres. AWWA

K. S. Watson
Pres. FSIWA

■ MEMPHIS MAYOR Edmund Orgill welcomed members of the joint meeting and spoke of the progress of the city of Memphis. The major city venture is a steam generated electric power plant — construction financed by a $163 million bond issue. The Closure Dam constructed between Memphis and President Island has made 960 acres available as an industrial park having access to Mississippi River transportation.

The city of Memphis obtains its water supplies from well sources and recently dedicated the $3,379,630 C. M. McCord pumping station designed for 15 mgd production. Untreated sewage and industrial wastes are discharged to the Wolf River which flows through a section of the city, but planning is underway to intercept all outfall sewers and provide for ultimate disposal to the Mississippi River.

Field trips to the Memphis Steam Plant and the Thomas H. Allen Pumping Station provided those in attendance the opportunity to view water works and city progress.

Abstracts of some of the papers presented follows:

■ OPERATION BOOTSTRAP by L. S. Finch, President of the AWWA.

"Operation Bootstrap" is the association's advancement program designed to seize the water works industry by the bootstraps and pull it up into its proper perspective within the minds of the public and the water works personnel. Too little appreciation is given to water resources as a requirement for community and industrial expansion and progress.

How does the water works industry compare with the other utilities which operate as a public service within the community—last ranked? The employees of the electric, gas, and telephone utilities are held in higher esteem and receive more remuneramunerations than their respective counterparts in the water works industry. Is the service of providing potable water supplies of lesser importance than these related public service utilities? Actually, a water treatment facility, treating a surface water supply, is confronted with an ever-changing operation, a factor which does not prevail among the other services.

The AWWA advancement program is designed to assist the water works operations at the local level through the local sections. If public appreciation is to be obtained, then the best water service must be provided. The objective of the association is to study and evaluate community water supplies as to their adequacy of systems, revenue, and appreciation.

Community systems must be prepared to meet future demands. The water supply system is no longer in competition with private well supplies but is confronted with meeting customer demand at present day inflated costs. Therefore, adequate rates must be obtained for adequate service.

The AWWA has appointed a director in charge of promoting the public appreciation of adequate water service at adequate rates. It is further prepared to assist by supplying bill stuffers, news stories and other media for distributing information. The association hopes to work with the Water and Sewage Works Mfrs. Assn. in this effort to advance the water works industry.

It is recommended that sections appoint committees to support this advancement program. Sections should look toward self improvement within their areas by sponsoring management courses or workshops where all classifications of water works personnel may meet informally to exchange ideas and learn of new methods by which they might improve their services.

The AWWA is also prepared to provide legislative assistance to sections. It hopes to serve as a clearing house, not a lobby, to help eliminate conflicting local, state and interstate legislature.

In relation to the forthcoming AWWA, dues increase from $10.00 to $15.00, a few criticisms have been voiced concerning the accomplishments of the association. An outstanding one concerns the slightly of the small water works operation. The president is appointing a committee to study the accomplishments of the association, in relation to its by-laws to determine if some area of responsibility has been overlooked.

■ Challenges Facing A Mature Federation by Ken S. Watson, President FSIWA.

The Federation is the center of 34 active sections, nine of which represent foreign countries. This membership of some 8,000 is dedicated primarily to the protection of surface water resources.

There is, however, little recognition or appreciation for protecting the public's health and welfare through the operation of sewage and industrial wastes works. Industrial wastes groups are not taking active part in the association. Further, there appears to be some public misunderstanding of what municipal and industrial waste problems are. This is reflected in the lack of research and funds for research in this field.

The FSIWA must obtain more funds in order to provide the additional service necessary toward upgrading the profession. The present dues of $5.00 are insufficient. The Journal itself costs over $13.00 per member and could not be produced if it was not supported by financing received from advertising.

The main challenge exists in the area of public relations. This could be materially aided by a study of semantics, for instance, "waste water" is not as harsh and depreciating as the word "sewage." "Reclamation Plants" may reflect better public understanding and appreciation than does the term "Sewage Treatment Plants."

Non-technical articles should be placed in newspapers and magazines for lay consumption. Such articles should maintain reader interest and leave the public with a honey-sweet taste of what he now considers an offensive subject.

The FSIWA is further challenged to provide educational assistance in the form of short course outlines, manuals and certification for plant operators. The waste water collection and reclamation personnel are generally last ranked among public utility services. The association is challenged to provide the leadership for upgrading the profession in the minds of the public.

■ Water Resources and Water Policy by Harold V. Miller, Exec. Director, Tenn. State Planning Commission.

Severe problems affecting the water resources of Tennessee have not become in evidence as yet, but based on similar experiences in the midwestern states, it may only be a matter of time. The western society acted only after the problem became paramount and not before.

Tennessee receives an average of 50 inches of rainfall, 30 of which is lost to evaporation, leaving 20 to be absorbed into the ground or flow as surface runoff. Stream flow throughout the state fluctuates tremendously. An example of the extreme exists at Shelbyville where maximum river flow may reach a high of 62,500 cfs and a minimum of 5 cfs.

Western Tennessee has large quantities of ground water while many areas in mid-Tennessee have small uncertain ground water resources. The major portion of the state is considered to have moderate quanities.

The water users of the state are predicted to increase their consumption many times the present rates as judged by past experience and anticipated trends. A 1955 to 1975 comparison:

	Billions of Gals	
Water User	*1955*	*1975*
Electric	3	8
Manufacturing	2.8	5
Irrigation	1	3
Municipal-Domestic	0.7	1.0

As shown above and considering this in the form of an index of average daily use (basing 1949 at 100 per cent) then 1955 would be at 217 per cent and 1975 at 488 per cent. By comparing this with the total available resource, future difficulty may be experienced in establishing priority for water users.

At present, there is no law in Tennessee concerning water use. The State legislature has provided for a complete study upon which to base law and has thus displayed foresight in having society prepared to approach the problem before it is upon them.

■ Design and Operation of Chemical Distribution Systems by V. W. Langworthy, B-I-F Industries, Inc., Providence, R. I.

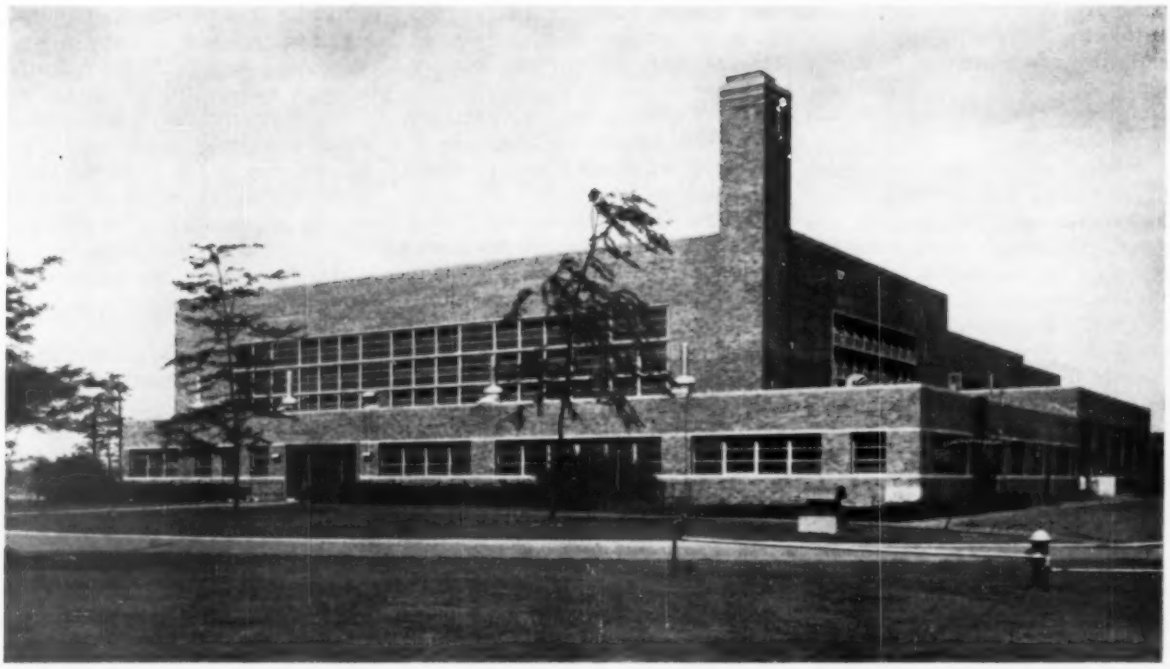
The design of transport systems for delivering dissolved chemical to the point of application has not received the same sound engineering approach as has the feeding equipment. An accurate measuring, completely dissolving chemical feeder installation is useless unless the solution can be transported to the point of application.

Solution feed lines fail in two ways: they corrode and leak, or they scale and plug. Any failure requires replacement or repair.

The practice of burying feeder lines makes replacement or repair difficult. Flexible hose has an advantage over rigid pipe in that it is easily placed into position and bending or flexing may often free scale from the inside of the tube. Using troughs instead of closed conduits is an alternate design to avoid sealing problems. Feeders should be located close to the point of application to avoid long lines which may develop siphon conditions.

To eliminate alkali scale, supersaturation of lime or soda ash feed solutions should be prevented. Calcium should be eliminated from soda ash make-up water. If calcium can not be removed polyphosphate complexing agents may be used. Calcium carbonate sludge from a softening process may be used to seed chemical feeds and precipitate calcium. Resulting sludges from this method must be kept in suspension in the feed line by velocities of 4 to 6 fps. Finally, if scale conditions persist, a small "godevel" similar to water main cleaners may be used periodically to clear lines.

Corrosion may be prevented by using suitable pipe linings, alloys and synthetic materials which will give protection from the strengths of the solutions to be handled.



AT THE HUNTS POINT sewage works in New York City, operating costs were reduced by the installation of a new type of . . .

Oil Filters *on sludge gas engines*

EDITOR'S NOTE: Harbor pollution control is one of the major and most challenging responsibilities of New York City's Department of Public Works, headed by Commissioner Frederick H. Zurmuhlen.

The design, construction and maintenance of the City's twelve modern sewage treatment plants, as well as two old screening plants, together with their 56 miles of intercepting sewers is supervised by the Department's Division of Sewage Disposal. The facilities operated by this Division treated a combined average of 715 mgd last year at a cost of $27.46 per million gallons.

In operation since 1952 and serving a major portion of The Bronx, the 120 mgd Hunts Point Plant is operating at an average flow of 113 mgd. The plant includes screening, grit chambers, primary sedimentation, aeration, final settling, sludge thickening, sludge digestion, utilization of sludge gas and disposal of sludge at sea.

One of the interesting phases of operation at Hunts Point is the use of a new type filter for purification of lubricating oil for the dual fuel engines. Information on this phase of operation has been made available to *Water & Sewage Works* through the Plant Superintendent, Adelbert I. Slocum, and Commissioner Zurmuhlen.

■ THE HUNTS POINT Pollution Control Project is powered mainly by four Cooper-Bessemer Type LS-8-GD 900 hp dual fuel engines. Two of the engines are direct connected through pneumatic clutches to drive 675 Kva generators or 21,000 cfm blowers. The load and air demands are such that three engines are required nearly 100 per cent of the time, the plant service factor for 1957 being 0.713. The engines are operated at full load a large part of the time, the capacity run factor for 1957 being 0.803.

The fuel used is digester gas (approximately 65 per cent methane and 35 per cent CO_2 with trace of H_2S) and No. 2D fuel oil in the ratio of about 9 per cent oil to 91 per cent gas on a Btu basis.

Before

The lubricating oil used since initial operation in 1952 has been a manufactured "Brand" quality mineral oil. The equipment originally installed to service and maintain the oil was a 55 gallon batch type oil refiner, two 100

In May, 1952 the 120 mgd. "step aeration" activated sludge plant at Hunts Point was placed in service. This project collects sewage in the Bronx from the Throggs Neck area on the upper East River to the junction of the area tributary to the Wards Island project. Generally, it serves the central and east portions of the Bronx covering 24.4 sq mi, an area roughly seven miles long north and south and about four miles wide east and west.

Located on the East River at Barretto Point near the foot of Coster Street, the Hunts Point Plant occupies a site of 25.5 acres. Of the total cost of $22,258,000, the 7.8 miles of intercepting sewers required were responsible for an expenditure of $5,670,000. The Throggs Neck Pumping Station built in connection with the project cost $350,000. The intercepting sewers range in size from 42-in. diameter to barrels 12 by 10 ft.

The Hunts Point Works eliminates pollution not only along the Bronx shore from Eastchester Bay to 149th Street but also along the North shore of Queens, from Great Neck to Flushing Bay. The 12 sewer outlets which formerly dumped sewage from the Bronx into the waters of the upper East River affected Queens as well as the Bronx, because winds and tides carried waste matter over to the Queens side. Since the Hunts Point Project went into operation a marked improvement has been noted in the waters of the upper East River and of Eastchester Bay.

gallon per hour centrifuges, and each engine was supplied with two cartridge type bypass filters and one series type full flow filter. The bypass filters clogged after about 600 to 700 operating hours, requiring renewal of the throwaway cartridges. This operation entailed the drainage of the oil from the filters and the replacing of 14 units in one filter and three units in the other. Two man days' labor were required.

Experiment

A new type of bypass filter, the Norse Electric C J C Number 35 Finefilter was installed and put into operation May 31, 1955, in the lubricating oil system of No. 1 Engine for a three-months' test period. (The design of these filters is shown in accompanying illustrations and diagram.) Engine No. 1 had had 15,958 hours of operation without a piston ring overhaul.

Oil was changed on May 31, 1955, the regular bypass filters cut out and the C J C filter cut in. The normal centrifuge schedule was continued, approximately 800 gal per day being passed through the centrifuge from each running engine. No. 1 engine was loaded with a generator throughout the test at approximately full load for 18 hours and 0.6 load for the other six hours of each day.

Determinations of water and sediment, precipitation and acid number were made periodically on samples of the oil in the engine.

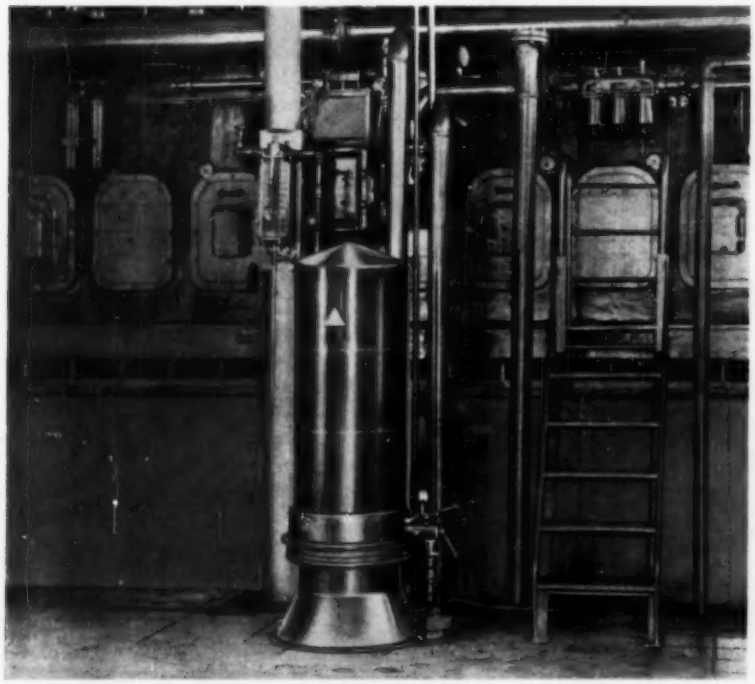
No. 2 engine was operated under similar conditions, using the cartridge type filters and being loaded by a blower at about three-quarters load for twenty-four hours a day. This engine was chosen for comparison because the total hours of operation since installation, without change of piston rings, was 14,900 as compared to 15,958 for No. 1 engine. The oil was changed and the filter units renewed before the start of the test.

The tests with the C J C filter on No. 1 engine and the cartridge type filters on No. 2 engine were conducted as follows: After the acid number reached 0.9 the oil was changed; when the filter was loaded it was cleaned. These changes were as follows:

Test Hours	Oil Changed	Filter Cleaned
700	#2 Engine	#2 Engine
944	#1 Engine	
1520		#1 Engine

The C J C test filter was cleaned and then installed on No. 4 engine for another test run of one month's duration. This engine had recently been overhauled, having only 2971 hours of operation since the installation of new piston rings. Throughout this test period of 672 hours, the oil remained in good condition, the acid number remaining at 0.6 or less. The water and sediment or precipitation reached only 0.1 per cent in both test runs with the C J C filter, whereas in the run with the cartridge-type filter, the water and sediment reached 1.2 per cent at 700 hours.

As a result of these tests, C J C filters were purchased and installed on all of the engines. The test filter was left on No. 4 engine. New filters were installed as follows: No. 1 and No. 5 engines on Aug. 2, 1956, and No. 2 engine on Feb. 21, 1957.



CJC FINEFILTER installed alongside one of the four Cooper-Bessemer dual fuel engines at Hunts Point sewage works.

After

Since these filters were installed, records have been kept of their operation. They have been cleaned a total of fifteen times to June, 1958, with an average period of 2743 engine hours between cleanings. A total of 4500 filter skins have been used and 751 fil-

OIL travels along the edge of the filter discs at the rate of 60 gal per hr. This unit is shown with the dust cover removed. Dust cover is at left.

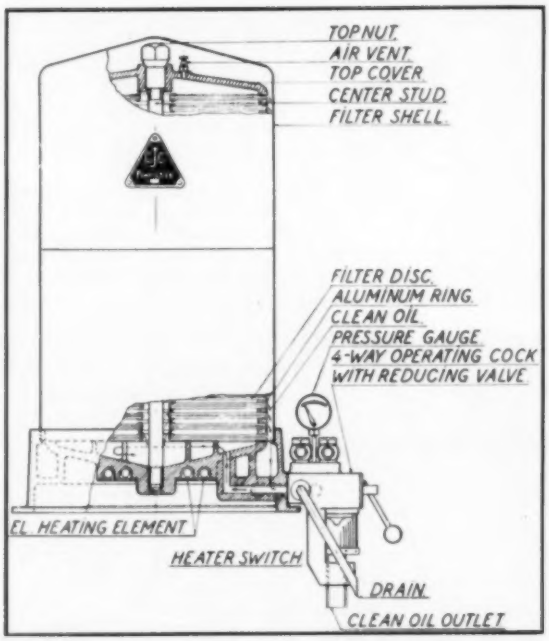


DIAGRAM shows construction and provision of electrical heating arrangement when engine is not running or when filter is some distance from the engine serviced.

ter discs, or an average of 300 filter skins and 50 discs per cleaning. The labor required is four man days per cleaning. The cost breakdown is:

Per cleaning—			
300 filter skins	@	.374 ea.	$11.22
50 filter discs	@	1.98 ea.	99.00
4 man days labor	@	17.60	70.40
			$180.62

Filter maintenance cost per engine hr.

$$\frac{180.62}{2743} = \$0.0658$$

The cost of operation of the cartridge-type filters based on 700 hours between cleanings was:

Per cleaning—			
14 cartridges	@	4.96 ea.	$69.44
3 cartridges	@	6.25 ea.	18.75
2 man days labor	@	17.60	35.20
			$123.39

Filter maintenance cost per engine hr.

$$\frac{123.39}{700} = \$0.1763$$

The savings in filter costs using the C J C units is therefore $.1763 — $.0658 = $0.1105 per engine hour.

Since the yearly engine hours in this plant average 25,000, the annual savings in filter cleaning costs is

$$25{,}000 \times .1105 = \$2{,}762.50.$$

Oil Saved Too

A check on lube oil consumption showed a saving in oil since the installation of the last C J C filter. The average consumption for the years 1954 to 1956 inclusive was 787 gal per month as compared to the average for the year ending Feb. 28, 1958, of 657 gal per month, or a reduced consumption of 130 gal per month. This consumption is, however, affected by the condition of the piston rings, as well as other factors.

Since the installation of the last C J C filter, it has been found that very little dirt is removed by the centrifuge, the use of which is now solely to detect and remove water from the oil. Water is detrimental to these filters, and it was necessary to clean No. 5 filter and renew all the discs after a water leak on No. 5 engine.

As was indicated by the original test runs, the control of the acid number depends on the condition of the piston rings; the nearer the time for an overhaul, the more frequently is it necessary to change the oil. There is approximately a 10 per cent loss in the refining of the used oil.

It has been the practice to weigh the dirt removed from the filter when cleaned, and the average was 107 lb per cleaning or 107 lb for every 2743 hours of operation.

The cleaning operation is not difficult and is easily finished in four man days. Care must be exercised in the handling of the discs since these are used for more than one operation of the filter. They should, however, be discarded after two or three runs. It was found that, if the filter disc pile was tightened down too tightly after cleaning, the flow of oil was greatly restricted and would stop completely in a short time. It is better, therefore, to maintain a pressure on the discs just enough to prevent leakage past them.

The filters are located on the engine-room floor at the engines, and the discharge from the filter is by gravity to the engine sump tank. They can be inspected during operation by removing the dust covers.

As a result of the experimental study and the installation of this new type of filter, the operating cost of power phase of the Hunts Point Plant were materially reduced and operations improved.

Our changing way of life, decentralization of industry, and fire protection should all be considered in designing for

Future Water Demands

by A. H. GENT, Chief Engineer
Illinois Inspection Bureau, Chicago, Ill.

EDITOR'S NOTE: In this paper, presented before the Illinois Section, A.W.W.A., the author discusses planning as a tool and a necessity for water works operation. He lays special stress on planing for future fire protection and points out that by using National Board of Fire Underwriter standards in planning, a system may be completely ready for future expansion.

■ THE FIRE PROTECTION PHASE is a sufficiently vital part of the water supply business to warrant the discussion of the future development of facilities by an engineering representative of the fire profession. To emphasize the significance of the future, there follows a quotation from an address given by Hon. Ben West, the progressive minded Mayor of Nashville, Tenn. Mr. West, in his presentation "The View Ahead," made this statement:

"Success in accomplishing an ultimate goal comes easy so long as you can *See* ahead. If the road turns, or you are approaching the crest of a hill beyond which you cannot see, any vision you might have concerning the panorama beyond must of necessity include some guess work. The minds of men have not been given the power to look into the future for any great distance. To predict the future accurately and soundly is at times impossible. But does this mean that we are limited to the present and that the future must be ignored or regarded as something which will take care of itself? Lots of folks permit themselves the pleasure and the ease of such an attitude as not worrying about the future because it *will* take care of itself. Government officials, and when I say that I am not confining the group to elected officials only, but also include appointed officials, cannot conscientiously permit themselves the luxury of living entirely in the present, or to bask complacently in the glorious reflections of the past. I have always found it conversationally pleasant to reminisce with friends over past accomplishments and noteworthy events. This invariably makes for pleasantly delightful conversation to pass the time, but the future welfare, the continuation of progress, the upgrading of our living conditions and prosperity, the preservation of our lives and property, the safety and health of our people depends not altogether on our past deeds but upon the plans we devise and formulate in the present for our guidance and conduct in the future. To make these plans with any degree of enlightment the two known and accepted factors of past and present must be combined with the third, and undetermined, factor, the future, and all three considered together. The knowledge gained, the experience acquired, and the mistakes made in the past must be blended with the availability of present resources, and knowledge acquired. These in turn must be applied to those elements of the future which are within the range of our comprehension. When this formula is utilized, it is at least possible, in my opinion, to prepare intelligently for the future."

Planning; A Necessity

With these basic elements of forecasting kept in mind planning can be more than an educated guess. This approach has already worked in many places, and is recommended as, at least, a partial answer to future problems. "Basking complacently in the glorious reflections of the past" has already resulted in serious water deficiency situations involving restrictions of normal domestic and industrial uses. Regional deficiencies in ground water supply and run off caught numerous communities with short supply, but a great many shortages resulted, even when the source was satisfactory, due to the lack of forethought. The future will not take care of itself; it must be carefully thought out.

"*Planning can be more than an educated guess.*"

The Illinois Inspection Bureau, representing the fire insurance business, has a very tangible interest in the future of water supply operations. While it has have never operated a waterworks, nor designed one, it is constantly on the rim of such procedures, endeavoring to obtain cooperation and interest in fire problems. In this day and age, with increased prices the usual thing, the continued nominal cost of fire insurance and the ability of an insured to obtain proper, full coverage can only be assured through the maintenance of satisfactory preventive and protective facilities.

Since the supply functions are considered the most important in this campaign against the common enemy, fire, everyone is in the fire business. Until the electronic or other future scientific profession develops a push button operation which will inhibit large scale burning, water will continue its almost universal fire use. Because of the present lack of even a vague possibility of this electronic development for general fire operations as we know them, the Fire Department Instructor's Conference, through its Exploratory Committee on the Application of Water, and the National Fire Protection Association are studying better techniques for water use. These studies definitely

show possibilities of conservation since one phase involves the development of improved larger capacity water spray application techniques for very short durations as compared to the present method where materially longer durations of water application are the common thing.

Some use was made of this method in the recent Malibu Beach brush fire disaster, where, even though water was mainly in short supply, of 1540 homes in the area, only 84 burned. However, for major municipal operations, it is the general opinion that the present prescribed duration of fire demand must still be contemplated for a considerable time in the future.

General Recommendations

Being on the rim of the design and operating phases of the profession, a specific blueprint to follow cannot be offered. However, presenting some observations which were made in almost 25 years of being on this rim position in Illinois may be helpful in designing for future demands. They are derived from experience in the small to medium-sized municipalities within our jurisdiction.

Providing potable water in good quantity through service meters for domestic and industrial uses is always the prime thought with waterworks people and normally provides the means for the improved design necessary to meet increased demands. The continued ability to sell all the water one can put through the meters is advantageous as a going concern must operate that way. If a product is selling in a mercantile establishment at a profitable price, the worst thing that can happen to that business is the termination of or the restriction of the supply of that product.

It is interesting to note recognition of this in your business as expressed by a very able water supply engineer who, when commenting on the fast rising populations along the Lake Michigan shore area, stated "First, improvements in quality were the problems of serving water. Now, quantity is the problem on hand to be carried out." Water supply is now a boom business. The customers want water and get irritated if they can't have it, so it is essential to get set up to sell it, with continuity of service assured even during periods of maximum demand.

The implication is not to be wasteful with this very valuable product. Every means should be taken to eliminate unwarranted misuse of the privilege of abundance. Water waste through service and main leakage, unauthorized use of fire hydrants and other unmetered connections should be and can be closely checked. Sprinkling controls, which discourage unnecessary waste, but still permit the maintenance and retention of the grass and foliage so necessary to the beauty of homes and outdoor recreational facilities, should be given further study. Recirculation of cooling water or other means of reclaiming such supplies may appear to be necessary in plans for the future. Following these and other steps toward conservation, sell all the water that can be sold.

> "... *To conserve for fire safety requires definite forethought.*"

Fire Protection Requirements

This demand must come off the top of the barrel. What is left is the fire protection reserve to provide the volume and the pressure required for public fire protection and to supply private protection facilities such as automatic sprinklers and standpipe systems. With per capita use at an all time high and maximum hourly rates for domestic and industrial use sky rocketing it is easy to see that to conserve for fire safety requires definite forethought. Robbing the major portion of the bottom of the barrel to take care of the top is surely not good design.

In looking forward, keep close watch on trends in domestic and industrial demands, watch water waste and features which can reduce or better regulate peak hourly demands and design liberally for the fire protection reserve. This reserve should be sufficient to meet the fire service requirements prescribed by the National Board of Fire Underwriters. These have always been considered liberal by water works authorities, but actual experience with major fire operations, even in smaller communities, indicates that they are close to correct. In fact heavier demands in small to medium-sized cities have been experienced because of the ever increasing availability of multiple fire pumper company response through our present wide spread fire department mutual aid programs.

While smaller communities may find it difficult to accomplish, since this fire demand represents a large percentage of the total, varying from about 80 per cent or more in cities under 5000 to about 60 per cent in cities of 25,000 population, compliance with these requirements to the greatest degree possible is definitely urged.

These fire service requirements are contained in the "Standard Grading Schedule" of the National Board and a completely revised 1956 Edition is now available. This publication should be in the library of all men engaged in water supply design. Its requirements should be a part of every modern waterworks man's knowledge.

In addition, the recommendations of the National Board of Fire Underwriters contained in their reports on the larger cities should be carefully considered in the design for future demands.

Since this standard requires delivery of maximum domestic, industrial and fire demand, not only with every portion of the system functioning but also with disruption of a reasonable number of components, it may be seen that design along these lines readily lends itself to meeting the unexpected increases in service requirements which are so common in our modern world. Moreover, experience shows that systems designed and expanded along these lines are materially less susceptible to the necessity for restricted service and emergency operations to meet these unexpected loads.

At times these reliability requirements, such as meeting maximum fire and domestic demands with an intake, purification unit, two wells or well pumps, two high or low lift pumps, a storage facility, a supply main and a power facility out of service, have been criticized as severe but experience indicates that failures have occurred and such characteristics have definitely proven of value under expanding loads. Furthermore, with the requirement for an adequate looped

arterial system met, and other recommended distribution system features provided, an excellent basis for expansion exists.

Multiple Supplies

In guiding design for water quality and source development the various State departments concerned with such matters do a tremendous job and their wealth of data will continue to be a basis on which these features will grow and improve. It has been interesting to note recent trends in Illinois toward the use of more than one of the major types of supplies common to this State; namely, wells, natural waterways and lakes, and artificial or impounded reservoirs. This may be the answer to protecting against periodic regional deficiencies in run off and ground water, which have so greatly affected our sources in recent years. For instance, cities with impounded supplies have supplemented these with supplies from our major rivers or from wells, where ground water was also available. Cities with well sources have supplemented these with natural or impounded surface water. The use of multiple outlying well stations, discharging directly, and in some cases with individual treatment facilities, has also been of value to many cities in making best use of the ground water available and can be helpful in partially caring for localized deficiencies in distribution characteristics.

The changing character of our communities is a major factor in our future considerations. Due to the automotive transportation system with necessary road and highway projects, the public's desire for suburban living, the dispersion of industry and educational construction policies, major industrial, mercantile and educational facilities are rapidly moving to outlying areas which historically have been considered areas of low water demand. Our past in many cases is catching up with us now, since few systems were designed with this possibility in view. The few that were are indeed fortunate and are cashing in industrially on this foresight. At the same time older residential areas are being converted to apartment house, industrial, housing project and other higher demand uses, which require reconsideration of design.

For those communities which have industrial ambitions, and due to the curtailment of use of important natural resources usual to certain regions this problem of serving outlying areas becomes foremost.

Industrial Needs

Industry must have adequate and reliable water for industrial, sanitary and fire protection uses. If they can't get it they go elsewhere, because regardless of the present inflationary trend they are still economy minded and know that development of private facilities is expensive. In the earlier days of decentralization, right after World War II, they took the glowing publicity of local authorities as gospel, but many times following construction were confronted with a sad situation. Now they look before they leap and are not taken in twice.

> *"It is not possible to guide any design for the future without adequate operating records."*

The automatic sprinkler system is the protective device mainly used by industry to assure continuity of operation of all portions of its production facility and to reduce insurance costs to a minimum. Remember how Oldsmobile production and sales suffered after the destruction of their unsprinklered automatic transmission plant at Livonia, Michigan and one can understand why they desire such systems. An adequate and reliable public water supply system is considered the best source of supply for this facility and industry is constantly looking for locations where such a supply can be made available.

These systems have an enviable record. Data kept for more than 50 years shows that they have proven to be over 96 per cent efficient. This efficiency factor is based on fire control with a small number of heads operating. The opening of a large number of sprinklers in a fire area, definitely smacks of failure and is so recorded.

Due to this ability, it would seem that water authorities would encourage these installations. Fire authorities do and these systems are commonly referred to as the "Fireman's Best Friend." Frankly, if you are looking for conservation, here it is in a nutshell. In the major fires experienced in unsprinklered properties, millions of gallons of water were used over long periods of time to establish control. Compare this with the comparatively low flow occasioned by the automatic opening of not over ten sprinklers at about 20 gpm each to establish control. The device furnishes both automatic alarm and fire control service. Major fires occur mainly during periods when premises are unattended and the alarm is delayed, and as a sentinel sprinkler systems have an excellent record.

Once it is installed and a satisfactory water supply connected, various factors must be watched as water service problems change, so that the future efficiency of sprinkler systems will not be impaired. Among these factors are changes in operating personnel, practices, and procedures, maintenance operations, changes in the location of elevated tanks and pumping stations, changes in consumption of a city as a whole, and in the local area under consideration, deterioration of pipe capacity because of tuberculation, closed gate valves, deterioration of supplies or reduction in capacity of pumps being depended upon. Consideration of these in continuing a system's efficiency is a must.

Records

It is not possible to guide any design for the future without adequate operating data and records pertaining to the past and present. Furthermore, efficient operation is not possible without these records. Detailed plans and records of operation, source, supply works, distribution and services in accordance with the recommendations of this Association is not an extravagance; it is as much a necessity as it is for any going corporation. Instrumentation should be complete for the supply works and for the distribution system. Remote recording elevated tank and reservoir level instruments and recording pressure gages in various areas of the system are vital in determining where reenforcement must be accomplished in view of growing demands.

With the supply works designed to meet, and to be expanded to meet, the maximum expected 24-hour do-

mestic and industrial demand with necessary duplication provided to assure continuity of service factor, it appears reasonable to depend on treated water storage, either elevated or surface with pumps to contribute to a large degree to the maximum hourly and fire demand requirements. Lack of maintenance of source and purification facilities at the top efficiency necessary to produce maximum allowable rates of flow can definitely contribute to plant inability. Only where raw water is considered satisfactory for direct use, is treatment plant by-passing, to add to ability to provide fire demand, recommended. Where surface storage is provided in conjunction with the supply works, high lift pumping capacity and supply main capacity should be ample to produce, even with some disruption of service, a rate of flow at least equivalent to the rate of flow of the effluent of the purification plant or low lift pumping equipment, plus a rate of flow equal to the surface storage capacity divided by the required fire flow duration period. Otherwise a water plant's ability to serve fire flow demand will be limited.

In selecting the size of distribution storage, elevated or surface with pumps, maximum hourly demand must be contemplated so that during such periods a fire reserve will be retained. Where supply works facilities are less than the maximum expected 24-hour day's demand and experience indicates that days of this type can occur in succession, continued dependence on distribution storage to furnish maximum hourly rates will eliminate its value both for fire and day by day consumption purposes. This is also true where the main capacity serving a local area in which a storage facility is located is less than the 24-hour maximum use in that area.

Distribution system storage is exceedingly valuable to provide maximum local short duration demands and thereby reduce arterial system pipe sizes, but general system ability to maintain this storage is of prime importance. Outlying well, pump and treatment facilities at these storage locations have been used for their proper maintenance, but even when these are provided, the availability of sufficient arterial main facilities to high value areas is necessary to utilize storage to support fire demand in those districts which require high short duration rates for fire flow. Where large standpipes are installed and there is little ground elevation advantage, the provision of pumps to utilize the lower portion of the standpipe capacity, at good pressure, is recommended.

Design

For general distribution system design, refer to a very excellent paper by George W. Booth, (AWWA Journal, Vol. 36, No. 9, 1944). Mr. Booth describes in a very complete manner the arrangement and pipe sizes necessary to give practical service ability for both present and future demands. The future arterial system should be planned to take care of local service and also add somewhat to transmission ability. In industrial, mercantile or institutional areas, the use of a liberal amount of 8 in. pipe for distribution, served by looped arteries of larger size, is highly recommended. Mr. Booth had this to say about 4 in. pipe: "In an effort to fix upon economic pipe sizes in design, there is the temptation to use a much too great proportion of 4-inch pipe, which with the passage of time and the consequent falling off in carrying capacity becomes altogether inadequate for the demands made upon it, even in ordinary residential sections. That tendency to use 4-inch pipe is much less common than formerly, and the great majority of systems employ 6-inch pipe as the minimum size." For complete fire and domestic service, 4-inch pipe should have no place in our future picture.

In any consideration of the future existing distribution facilities must be in proper shape for the expansion contemplated. Valve surveys to eliminate closed or inoperative valves, the provision of adequate size cross connections between arteries and distribution pipe, the cleaning of pipe to reduce tuberculation and the adoption of treatment to minimize its future collection and the elimination of air pockets at high points should be undertaken. Make sure the existing system is at its peak. Valve spacing should be investigated so that continuity of service on arteries and distributors will be assured and no great area will be denied supply because of a major break.

Provision of fire safe pumping stations, purification plants and waterworks buildings are as vital to you as they are to industry. Fire resistive construction and the arrangement of all facilities in a fire-safe manner is the only way for the future.

> "... *Water authorities could readily blueprint ... their plans for the future.*"

The reliability of power supply for pumping, purification and general operation cannot be overly stressed. Total elimination of service has occurred too many times in the past, due to lack of proper duplication, to overlook this feature. Electric service should be underground, and duplicated with transformer, control and sectionalized switchboard facilities properly arranged. Otherwise a secondary source of power, such as internal combustion engine, is a necessity.

The fire hydrant is the outlet provided for the use of the fire reserve by the fire fighting forces. The future installation of fire hydrants meeting this Association's requirements, with liberal flow characteristics at low friction loss and at least 6" connections to distribution mains, is urged. The replacement of fire hydrants having tortuous design and poor repair ability is a program which will further everyone's interests. Auxiliary gate valves, preferably on all hydrant connections, and at least on those connected to arteries, will improve continuity of service especially in view of modern traffic and the susceptibility of the fire hydrant to automotive injury.

Close fire hydrant spacing along streets in our high value industrial, mercantile and public building districts in accordance with the Underwriters' requirements is normally recognized as necessary by water authorities in view of the fire fighting problem presented. Multiple fire pumper company response, at times including mutual aid companies, requires numerous connection points,

close to the property to be protected, to deliver the desired fire flow through short hose lines. However, with the modern tendency for large parcels of ground beyond street fronts, the rear of these properties ordinarily require additional consideration. Where hydrants are placed for this rear service, care should be taken that they are located on all weather roads and accessible for the connection of fire department pumper suctions.

In single family, large lot residential areas there has been some tendency to extend hydrant spacing to 1000 feet or more on streets, with the thought that with modern small stream fog fire fighting methods, smaller ultimate fire flows will be necessary and two 500 ft lines of 2½ in. hose will be maximum required to serve the nozzle equipment used in fire fighting. This spacing, of course, is materially wider than the present ultimate recommended practice of about 350 to 400 feet. The fire fighting methods quoted as justifying this wider spacing are not as yet fully developed nor universally adopted and are not 100 per cent infallible. Also, some adaptations, which involve serving the suction of a fire pumper located at a piece of property through lines of 2½ in. hose stretched directly from the fire hydrant ports definitely require the closer spacing now used as a standard. This latter residential fire fighting method, using very short hose lines of 1½ in. size, preconnected to the pump is gaining wide spread favor due to the speed in getting water on the fire, using the water tank on the truck as the primary supply, and if needed later, supporting this mobile supply by 2½ in. hose lines extending to the pumper suction direct from hydrants. In any event, this wider spacing does not lend itself to reliability since inoperative or frozen hydrants can readily place the remaining hydrants outside proper hose line distances.

Master Planning

In these days of Master Community plants and zoning activities for municipalities and unincorporated country areas, water authorities could readily blueprint, at least to some degree, their plans for the future. This blueprint would have to be altered periodically to fit situations as they occurred, but a basic master plan for water system growth has some advantages.

It would be a tremendous advantage to water officials if improvements, to meet expansion and need for more adequate service, could be put in on a continuing basis, year by year, following this "master blueprint" using profits from the water supply operation for accomplishment. Compared to "growing like topsy" or making a large basically inadequate improvement at one specific time, so as to cover partially as many trouble spots as possible with the money available, long range planning makes sense. The consulting engineering profession has done and can do an excellent job along these lines. Frankly this line of thought is not new and at some places has been tried and is serving a valuable purpose in this period of expansion.

"Water officials should have available definite regulations and design standards. . . ."

Where extensions are placed in newly developed areas, the operation is usually on the basis that the cost of these extensions shall not be borne by the whole tax area but by the new users in the area being developed. As a result, design and installation of these extensions by subdividers and developers is common. If these installations are uncontrolled and unsupervised as to adequacy of design, the capabilities of your system can deteriorate rapidly. Furthermore, it is an injustice to the taxpayers using the existing system if an installation, below the standards which they originally paid for, is permitted.

Water officials should have available definite regulations and design standards for these extensions which must be met before permission is granted for service. These should cover service connection facilities, pipe, valves, hydrants, depth of cover, installation practice, pipe sizes and continuity of arterial feeders to mention a few. Plans should be approved before installation is started. Without such supervision trouble results.

There is also definite activity these days in the field of completely new water systems both for the older, smaller villages of less than 1000 population which desire these sanitary advantages and also for new communities segregated from existing public or private systems. The Inspection Bureau is often asked for requirements covering the fire protection aspect of these systems.

In view of characteristics of the older villages and the funds usually available for the initial installation, normally quoted specifications are based on the minimum which would be recognized for fire insurance rating purposes. This would include ability to develop at least 500 gpm from supply and storage for a one hour period in addition to maximum consumption through all portions of the system, with some thought for later expansion. In rapidly developing communities, initial design on a materially more liberal basis is urged, especially where industrial, shopping center and educational facilities are a part of the overall plan. Under such conditions, a fire flow of not less than 1000 gpm for at least 4 hours duration would be recommended. In addition, thought toward later supply works and distribution system expansion is urged.

Long range planning, not only for service but also for fire protection, is a must for every water supply organization.

Allegheny County Sanitary Authority

hopes to compiete 69 miles of interceptor and a 150 mgd treatment plant by March of next year. When these facilities go into operation, the wastes from 71 communities including Pittsburgh will be removed from the Ohio River and its tributaries.

Among the wastes prohibited in the sewer system will be septic tank sludge, neutralized acid wastes, and ground garbage from grinders of more than 3 hp. Also to be barred are pickle liquor, phenols, cyanides, gas tar, fruit pulp, feathers, grease, (above 100 mg/L) and wastes with a pH less than 5.5 or more than 9.0.

The Milwaukee Water Works recently issued completely revised specifications for . . .

Sizing Water Service Piping

by ARTHUR RYNDERS, Superintendent of Water Works, Department of Public Works, Milwaukee, Wis.

EDITOR'S NOTE: The author sets forth rather complete details on the present specifications of the Milwaukee Water Works for water service piping. The article, adapted from a paper presented before the Wisconsin Section AWWA is published for the benefit of other water works managers faced with the problem of controlling water service piping.

■ REVISED SPECIFICATIONS for water service piping were recently issued by the Milwaukee waterworks. Formerly, the specifications for service piping were incorporated in a publication entitled, "Rules, Regulations and Rates." The revised specifications, discussed herein, are concerned with the complete and exclusive subject of water service piping.

Water service piping is defined as the piping from the water main to and including the valve on the discharge side of the water meter. The piping from the valve on the discharge side of water meter to its terminus is defined as building piping and is beyond the scope of this specification.

Liberal sizing of the underground service pipe is encouraged, with a view to the future requirements of the customer. When the size of the service pipe is liberal the friction loss for the complete installation can be reduced by replacing the original meter with a larger meter, or by replacing part of the original building piping with larger piping, either or both of which can be done at a lower cost than installing a larger underground service pipe. Experience indicates that customers' requirements usually increase rather than decrease.

For simplicity in tabulating friction loss, the service piping was divided into (a) the service pipe, including all stops, valves, and fittings, and (b) the water meter. Friction loss tables are included in the specifications for both (a) and (b).

The specifications are arranged for the use of plumbers in estimating and installing future jobs. It is believed that if the tables for sizing service piping contained in these specifications are used, the plumber, the plumbing inspector, the water tap permit clerk, and all others concerned will have a common reference which will produce a satisfactory installation for the customer. The specifications also cover service piping for fire protection systems, but the sizing of this piping is outside the scope of this paper.

The specifications are divided into four parts. Part I, General, is divided into chapters on Definitions, Authority of the Commissioner, Special Notices and Permits, and Sizing of Water Services. Part II, Materials, has only one chapter; namely, Materials. Part III, Installation, is divided into chapters on Excavation, Connection, Piping, Structures, Backfilling, Sidewalk and Pavement Replacement, and Meter Setting. Part IV consists of Tabulations and Drawings.

Much of the early work of preparing these specifications was in the preparation of drawings. A few of these drawings are discussed briefly in the following.

Figure 1 shows tap service piping, copper, ¾ to 2 in. in diameter. The limits of the service piping, the location of the curb stop and considerable fabrication detail are shown.

Attention is called to the table at

Table 1

Supply Units for Various Types of Fixtures*

Type of Fixture	Control	Supply Units	
		Public	Private
Closet	Flush tank	5	3
	Flush valve	10	6
Urinal	Flush tank	3	--
	Flush valve	5	--
Bathroom group	Flush tank	--	6
	Flush valve	--	8
Shower	Mixing valve	4	2
Bath tub	Faucet	4	2
Lavatory	Faucet	2	1
Laundry trays	Faucet	--	3
Service sinks	Faucet	3	3
Hose connection	Faucet	6	3
Kitchen sink	Faucet	4	2
Dishwasher	Automatic	2	2
Garbage disposal	Automatic	2	2
Washing machine	Automatic	4	3
Air cond. (per ton)	Automatic	2	2

*Adapated from Nat. Bur. of Standards (BMS79).

Table 2
Estimated Flow for Total Supply Units*

Total Fixture Supply Units		Est.
With Flush Tanks	With Flush Valves	Flow, gpm
12	—	8
16	—	12
23	—	16
31	—	20
41	8	25
54	13	30
86	28	40
127	48	50
174	75	60
225	109	70
300	195	85
375	250	100
475	350	120
580	490	140
690	625	160
935	925	200
1,380	1,380	250
1,750	1,750	300
2,660	2,660	400
3,650	3,650	500

*Adapted from Nat. Bur. of Standards (BMS 79).

Table 3
Service Piping Selections for Various Flows

Flow, gpm	Service Pipe		Friction Loss, psi		Pressure, psi	
	Length, ft	Accept. Sizes	In Service Pipe	In Meter	At Meter Outlet	At Main
8	60	¾ x ⅝ SD	6.8	0.6	27.6	35
		1 x ⅝ SD	1.8	0.6	32.6	35
		1 x ¾ SD	1.8	0.4	32.8	35
		1½ x ¾ SD	0.3	0.4	34.3	35
	80	¾ x ⅝ SD	8.7	0.6	25.7	35
		1 x ⅝ SD	2.2	0.6	32.2	35
		1 x ¾ SD	2.2	0.4	32.4	35
		1½ x ¾ SD	0.3	0.4	34.3	35
	100	¾ x ⅝ SD	10.6	0.6	23.8	35
		1 x ⅝ SD	2.7	0.6	31.7	35
		1 x ¾ SD	2.7	0.4	31.9	35
		1½ x ¾ SD	0.4	0.4	34.2	35
12	60	1 x ⅝ SD	3.8	2.2	29.0	35
		1 x ¾ SD	3.8	1.1	30.1	35
		1½ x ¾ SD	0.6	1.1	33.3	35
	80	1 x ⅝ SD	4.7	2.2	28.1	35
		1 x ¾ SD	4.7	1.1	29.2	35
		1½ x ¾ SD	0.8	1.1	33.1	35
	100	1 x ⅝ SD	5.7	2.2	27.1	35
		1 x ¾ SD	5.7	1.1	28.2	35
		1½ x ¾ SD	0.8	1.1	33.1	35
16	60	1 x ⅝ SD	6.5	4.5	24.0	35
		1 x ¾ SD	6.5	2.1	26.4	35
		1½ x ¾ SD	1.0	2.1	31.9	35
	80	1 x ⅝ SD	8.1	4.5	22.4	35
		1 x ¾ SD	8.1	2.1	24.8	35
		1½ x ¾ SD	1.3	2.1	31.6	35
	100	1 x ⅝ SD	9.8	4.5	20.7	35
		1 x ¾ SD	9.8	2.1	23.1	35
		1½ x ¾ SD	1.5	2.1	31.4	35

the lower left of Fig. 1. Optional combinations of service pipe and meters are shown. The service pipe ranges in diameter from ¾ in. to 2 in. The meters range in size from ⅝ in. to 1½ in. The sizes of stops and valves are shown for each combination.

Figure 2 shows the number of full threads engaged between the corporation stop and the side wall of the water main. A minimum engagement of 4 full threads was considered reasonable, below which a threaded clamp is attached to the main. Taps above the zigzag line require clamps; taps below the zigzag line do not.

Figure 3 shows a meter setting of the basement type for ⅝, ¾, and 1 in. meters for copper or lead service piping.

Figure 4 shows a meter setting of the basement type for 3, 4, 6, 8, and 10 in. meters on cast-iron service piping. The usual, as well as optional, meter setting arrangements are shown.

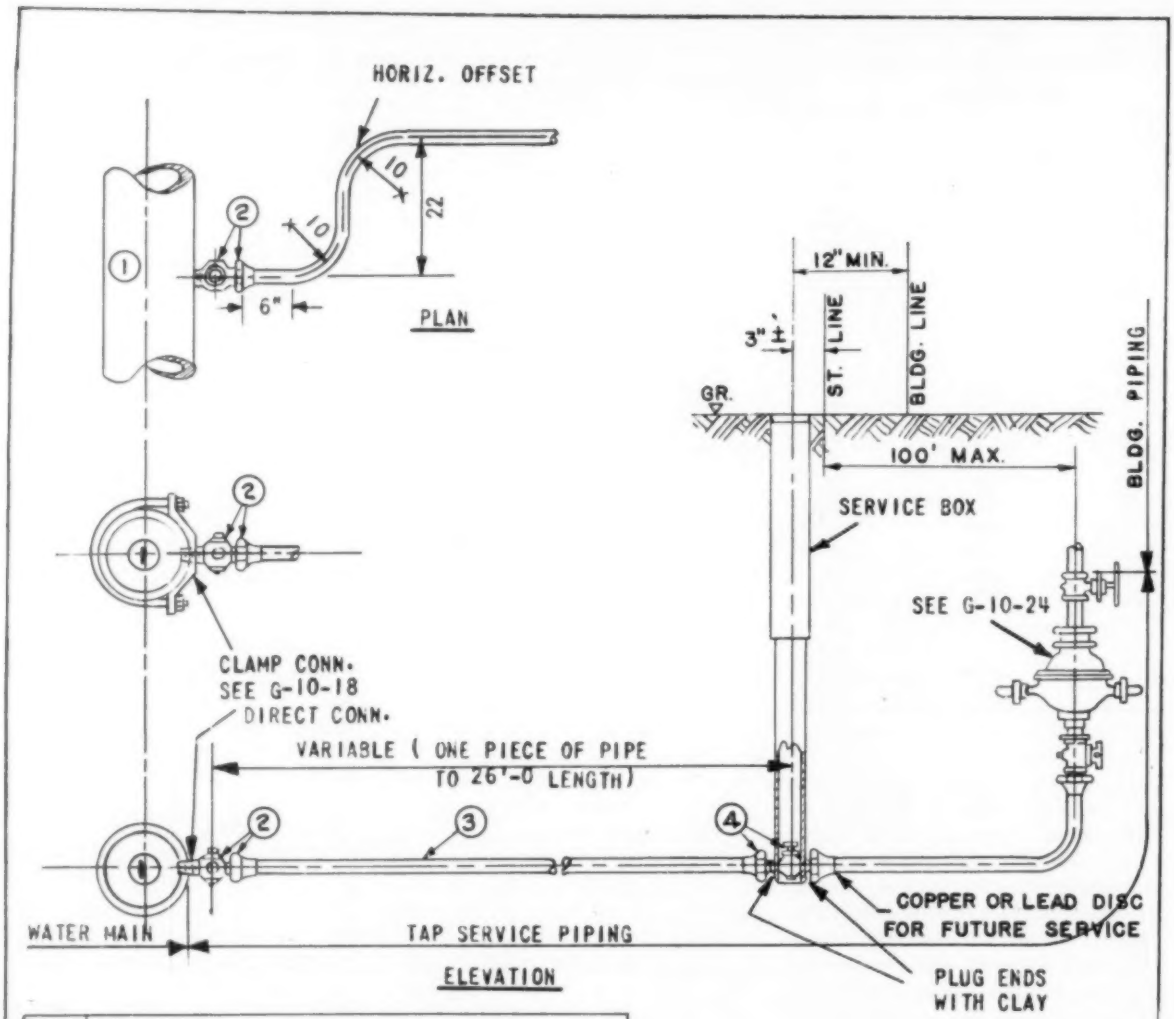
Altogether, 35 drawings are included in the specifications. These drawings show trench and tunnel bracing, clearances for tapping, all tap and branch service piping installations normally permitted, all basement and pit meter settings normally permitted, details regarding the construction of meter pits complete with trap doors or manholes, piping diagrams for domestic supplies and for the combined domestic supplies and private fire protection systems normally permitted.

After the work of preparing the drawings was well advanced the subject of sizing the service piping was taken up. The best reference on this subject was considered to be the National Bureau of Standards Report BMS-79. This reference recognizes a difference in the use of plumbing in public and private buildings. The reference also recognizes a difference between closets, urinals, and bathroom groups equipped with flush tanks and those equipped with flush valves. All the usual types of fixtures found in both public and private buildings are rated in terms of fixture supply units.

G-10-1 (see Table 1) is a tabulation of fixture supply units for both public and private buildings. Note that in a private building a lavatory with the usual faucet control has a rating of one fixture unit, whereas in a public building it has a rating of two fixture units. All fixtures listed have apparently been carefully rated in fixture supply units, depending on installation in public or private buildings. With this tabulation it is easy to total the fixture supply units in any given building once the number and type of fixtures is known.

Having the total number of fixture supply units, the flow in gallons per minute can be estimated from Table 2.

Having the estimated flow, the length of service pipe should be considered. Table 3 is typical of the tables which simplify this consideration. Obviously, the length of the service pipe will make a difference, particularly in the smaller sizes shown for each flow. The loss shown for the service pipe includes the loss through the corporation stop, the curb stop,



NO.	ITEM
①	WATER MAIN
②	CORP. STOP - COPPER CPLG.
③	COPPER TUBE - TYPE K
④	CURB STOP - COPPER CPLG. BOTH ENDS

SER. PIPE	CORP. STOP	CURB STOP	METER STOP	METER	METER OUTLET VALVE	METER HORN
3/4	3/4	3/4	3/4	5/8	3/4	3/4X5/8
1	1	1	1	5/8	1	1 x 5/8
1	1	1	1	3/4	1	1 x 3/4
1-1/2	1-1/2	1-1/2	*1-1/2	3/4	1-1/2	♦1x3/4
1-1/2	1-1/2	1-1/2	*1-1/2	1	1-1/2	♦1 x 1
2	2	2	* 2	1	2	♦1 x 1
2	2	2	* 2	1-1/2	2	NONE

* GATE VALVE ♦ BUSH SEE G-10-26

NOTE-
SERVICE PIPING TO BE APPROXIMATELY LEVEL FROM MAIN TO PROPERTY LINE

CITY ENGINEERS OFFICE
MILWAUKEE, WIS.
MILWAUKEE WATER WORKS

TAP SERVICE PIPING
COPPER

H. Stammann E. Adelmann
ENGINEER CITY ENGINEER

DRAWN W.S DATE 5-13-57
CHECKED O.A.H. SCALE 3/4" 1"
FILE 3-5-1 DWG. G-10-20

FIG. 1—TAP service piping, copper—¾ in. to 2 in.

MAIN DIA.	CAST IRON PIPE SPEC.	STANDARD SIZE SERVICE NUMBER OF FULL THDS. ENGAGED			
		.3/4" TAP	1" TAP	1-1/2" TAP	2" TAP
4"	M-38	3.22	2.76	.92	-.57
	250	3.92	3.36	1.50	-.09
	C	5.18	3.84	2.87	.80
6"	M-38	3.92	3.36	1.84	1.15
	250	4.90	4.20	3.45	1.84
	C	6.02	4.60	4.46	2.64
8"	M-38	4.90	3.84	3.45	2.53
	250	6.02	4.80	4.14	3.22
	C	6.72	5.52	4.83	3.91
12"	M-38	5.74	5.16	4.83	4.14
	250	7.42	6.60	6.09	5.63
	C	8.66	7.20	6.67	5.98
16"	M-38	7.36	6.36	5.98	5.63
	250	9.80	8.16	7.82	7.59
	C	10.50	8.76	8.16	8.05
20"	M-38	12.89	11.04	10.29	9.77
	250	11.76	9.84	9.20	8.97
	C	8.96	7.44	7.01	6.67

ABOVE ZIGZAG LINE - TAP WITH CLAMP
BELOW ZIGZAG LINE - TAP DIRECT

NOTE - MIN. OF 4 FULL THDS. REQUIRED FOR DIRECT TAP.

MATERIAL SPECIFICATIONS-
M-38 CITY OF MILWAUKEE SPEC. DATED 7-5-51
250 CLASS 250 - FED. SPEC. WW-P-421
C CLASS C - A.W.W.A. SPECIFICATION
TAPS - CORP. STOPS, A.W.W.A. TENT. SPEC. 7T. 1-7 TABLE I
M-42 CITY OF MILW. SPEC. DATED 10-7-53
SERVICE CLAMP

CITY ENGINEERS OFFICE
MILWAUKEE, WIS.
MILWAUKEE WATER WORKS

TAP WITH CLAMP
OR TAP DIRECT

A. Rynders ENGINEER Lloyd D. Knapp CITY ENGINEER

DRAWN
CHECKED O.A.H.
FILE 3-5-1
DATE 3-18-52
SCALE
DWG. G-10-18

FIG. 2—NUMBER of full threads engaged between the corporation stop and the side wall of the water main.

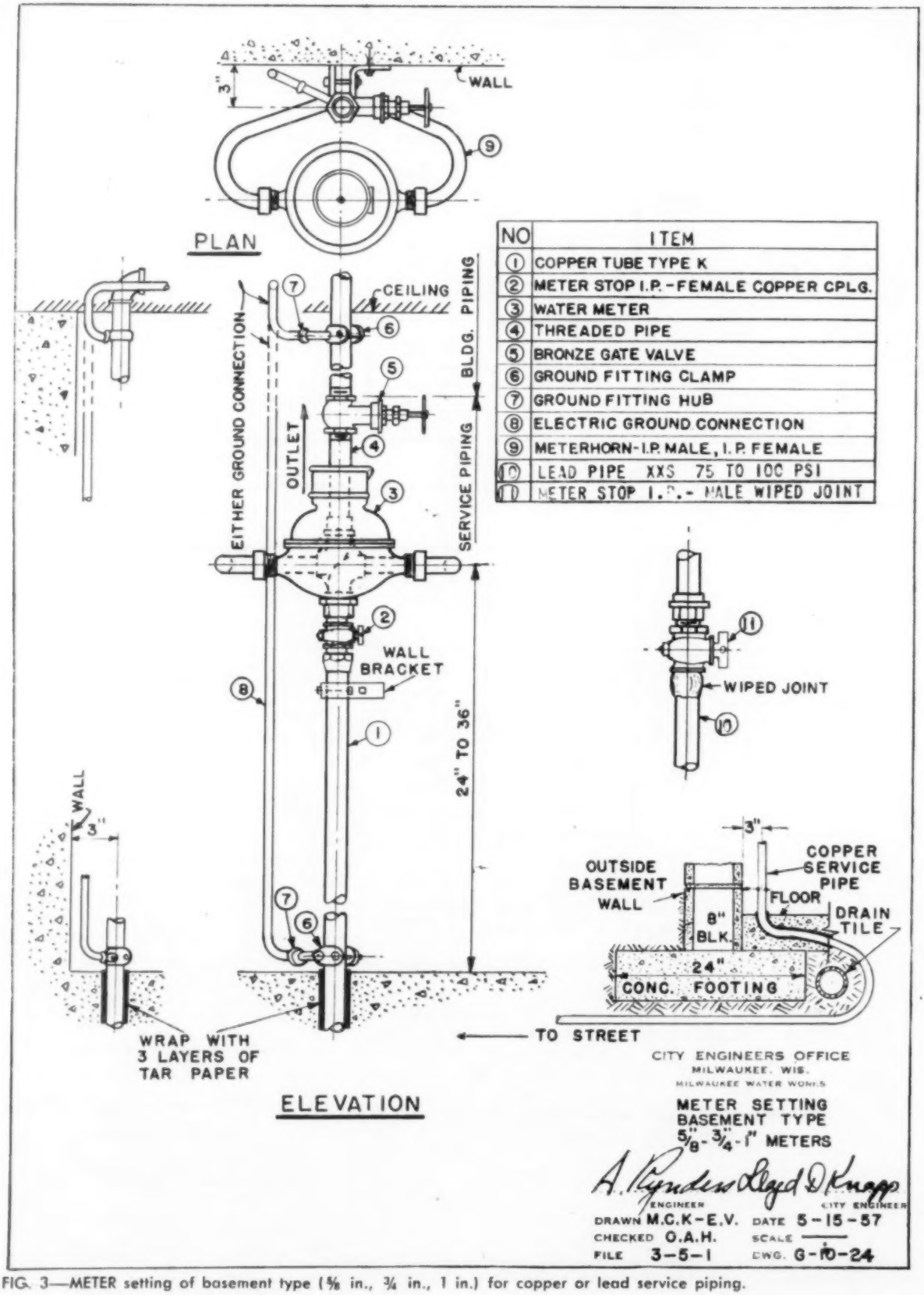
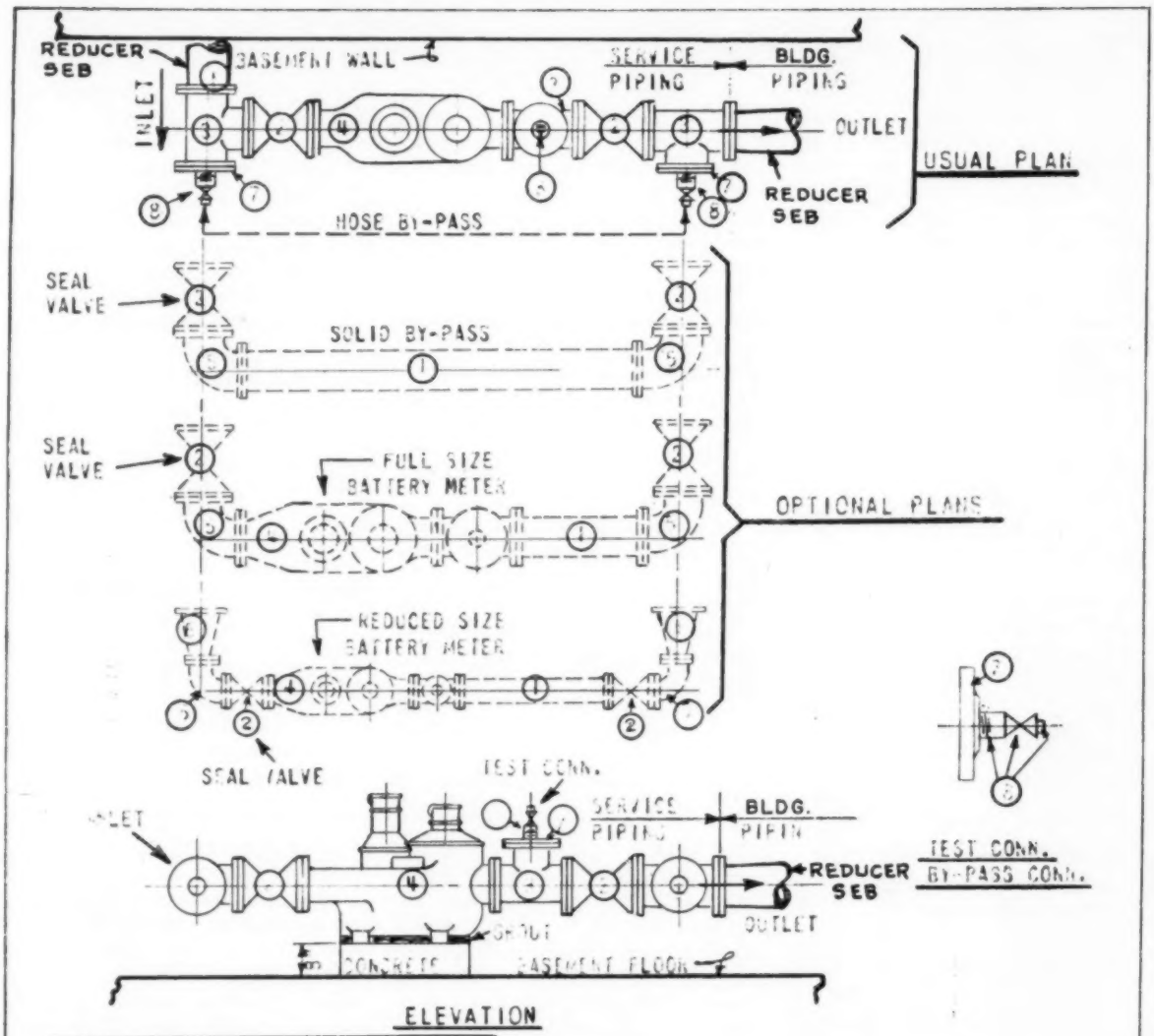


FIG. 3—METER setting of basement type (⅝ in., ¾ in., 1 in.) for copper or lead service piping.



NO.	ITEM
1	C.I. FLANGED STEEL PIPE
2	GATE VALVE - [illegible]
3	C.I. TEE
4	WATER METER
5	90° C.I. ELL
6	C.I. TAPER REDUCER
7	REDUCING FLANGE
8	NIPPLE - GATE VALVE - BR. PLUG 2" G.V. FOR 3"-4"-6" METERS 3" G.V. FOR 8"-10" METERS

NOTE: ALL FLANGES 125 LB. STD.
ALL STEEL OR W.I. FITTINGS
TO BE GALVANIZED

CITY ENGINEERS OFFICE
MILWAUKEE, WIS.
MILWAUKEE WATER WORKS
METER SETTING
BASEMENT TYPE
3"-4"-6"-8"-10" METERS

A. Rynders — ENGINEER
Lloyd D. Knapp — CITY ENGINEER

DRAWN J.P.S. DATE 5-13-57
CHECKED C.A.H. SCALE -
FILE 3-5-1 DWG. G-10-30

FIG. 4—METER setting of base[illegible] type (3 in., 4 in., 6 in., 8 in., 10 in.) on cast iron service piping.

and all valves and fittings in the meter setting.

Also, having the estimated flow, the size of water meter should be considered. The loss shown for the meter includes only the loss through the meter itself.

It will be noted in Table 3 that the pressure at the outlet of the meter is shown for various combinations of sizes of service pipe and meters. The pressure at the outlet of the meter is calculated on the basis that the minimum pressure in the main will not drop below 35 psi, which is considered to be a reasonable minimum pressure for the utility to maintain in the main at street grade. It should also be recognized that the utility may, from time to time, find it desirable to alter some of its service districts as long as minimum pressures do not drop below 35 psi. Also, on the basis of 35-psi pressure in the main, the size of service piping recommended in these tables, and reasonably sized building piping, adequate pressures will be available for use at all fixtures in buildings not more than two stories high.

Presently, actual pressures in the Milwaukee distribution mains vary from 105 psi to something below the 35 psi chosen as a basis here. Actual pressure at the outlet of meters will vary through even wider limits. The regulation of pressures at the outlet valve of the meter is not considered to be a function of the service piping, but rather a function to be incorporated in the building piping by the use of pumps, reducing valves, or other means.

It will also be noted in Table 3 that several options are shown for water service size. As previously stated, all of the options shown are acceptable; they are intended for the use of the plumber in figuring costs of various acceptable installations and agreeing with his principal upon a particular installation.

To review and summarize, the steps in sizing water service piping using the proposed specifications are as follows:

1. Determine from the building plans whether the building is public or private.
2. Determine from the building plans whether flush tanks or flush valves are to be used.
3. From the building plans list all the fixtures to be supplied through the water service piping.
4. From Table 1 determine the number of fixture supply units and the total.
5. From Table 2 determine the estimated flow in gallons per minute.
6. Using this or the next larger estimated flow, select from Table 3 the length of service pipe nearest the length shown on the plans. Note the alternate sizes of service pipe and meters which are acceptable.

Acknowledgements

The author wishes to acknowledge the work of O. A. Halvorson, Mechanical Engineer, Water Construction Division, who compiled most of the specifications; W. McIntyre, Supt. of Meter Division, who contributed much practical information; Ralph F. Weber, Executive Secretary, Milwaukee Plumbing Contractors Association; Robert T. Flint, Supt. of Bureau of Plumbing Inspection; John Wilkenson, Engineer, Fire Insurance Rating Bureau; and many others who also contributed by reviewing and commenting on these specifications.

Federal Grants for the Construction of Sewage Treatment Works

The Construction Grants Program which under the Federal Water Pollution Control Act was authorized $50 million per year to assist municipalities in the construction of sewage treatment works has, since inception to February 28, 1958, appropriated $95 million for this purpose. Projects completed number 80, under construction 395, and approved and awaiting construction 438 for a total of 913.

Status of grant offers made and applications pending:

	No.	Estimated Project Costs (Millions $)	Grant Offers Made or Requested (Millions $)
Grant Offers Made	913	362	76
Applications In Process	622	583	66
Applications Under Preparation	283	104	22
Total	1818	1049	164

Estimated impact on employment due to sewage plant construction based on the annual authorized appropriations of $50 million will stimulate some $250 million in total sewage treatment works project costs. The estimated on-site payroll for this construction is $75 million which will support approximately 13,000 man years of labor. Off-site employment related to this construction will be approximately equal to this by producing a total annual payroll of an estimated $150 million in support of about 26,000 man years of labor.

The Law of Water Allocation

A book of 643 pages, priced at $7.50, titled "The Law of Water Allocation," is the outcome of a symposium sponsored by The Conservation Foundation, held in Washington October, 1956. The book includes an analysis of riparian law in three eastern states and a review of certain types of water use in western law and practice. The constitutionality of recent legislative alternatives and further research needs are carefully examined.

The editors, David Haber, Professor of Law, Rutgers University Law School, and Stephen W. Bergen, Assistant Director of Research, The Conservation Foundation, have incorporated contributions from the fields of law, economics, engineering, hydrology, and state and federal resources development and administration. Case studies of problem areas discuss political and economic issues. State water planning and development are covered in two papers by economists in an evaluation of water law and economic analysis.

The growth and decentralization of industry, the growth of metropolitan areas, the increasing demand for water recreation areas, the increasing use of supplemental irrigation in farming areas, are trends which require the redefinition of water rights. This is the problem in eastern states and legislative study and research groups are trying to resolve conflicts of interest over water rights resulting from the increasing competition over supplies.

The book published by the Ronald Press Co., 15 East 26th Street, New York 10, is designed to serve as a guide book for all who are interested in the orderly solution of conservation problems.

SOLUBILITY and PERCENTAGE SATURATION of . . . Oxygen In Water

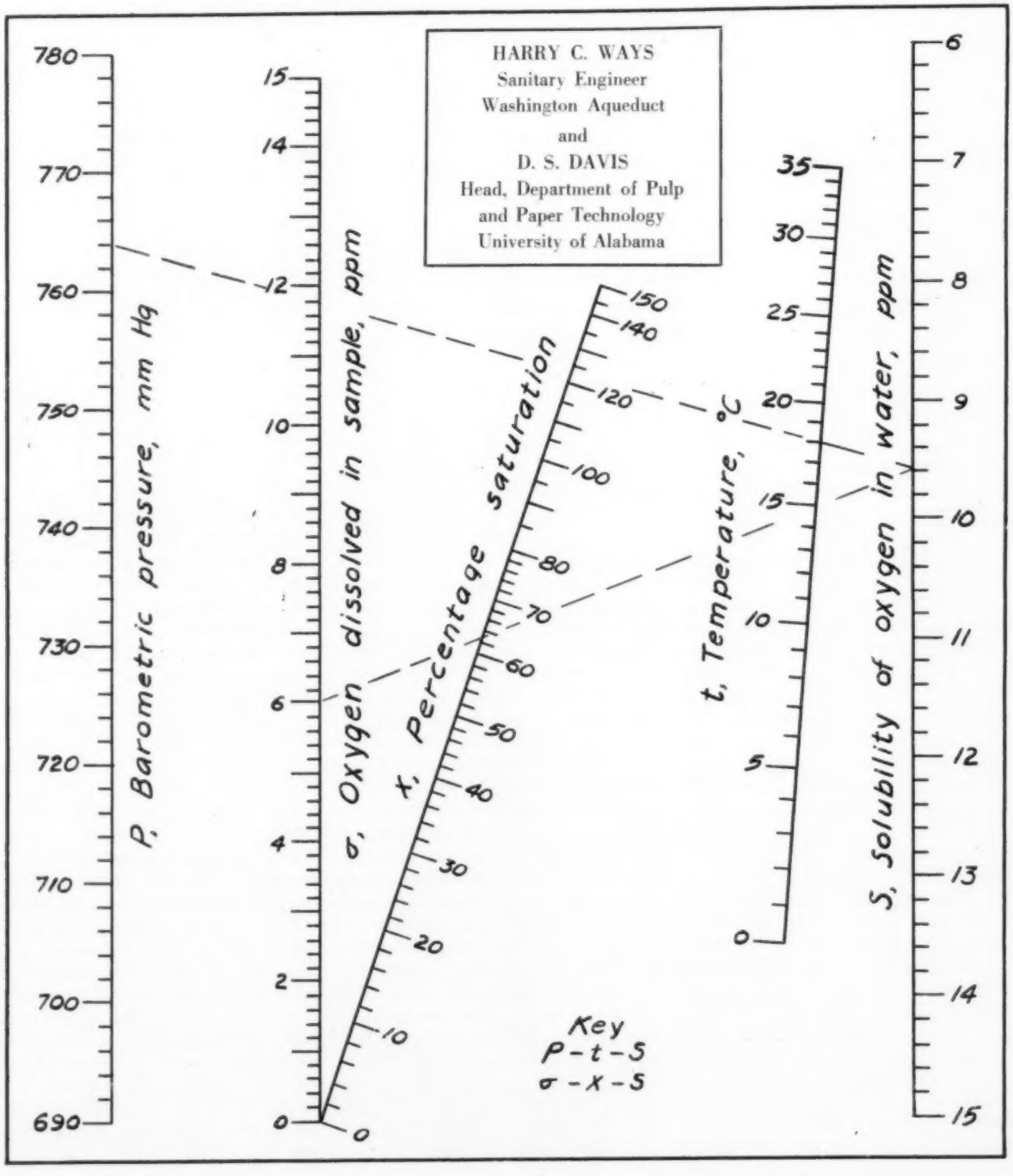
A previous nomograph for the solubility of atmospheric oxygen in water is herewith modified by well-known methods to yield, in addition, percentage saturation. The new chart provides solution of Hatfield's equation (Sew. Wks. Jou. 73:557—1941)

$$S = \frac{0.678\ (P - \mu)}{t + 35}$$

and the equation $x = 100\ \sigma / S$

where S = solubility of oxygen, ppm
P = barometric pressure, mm of mercury
μ = vapor pressure of water at t° C
σ = oxygen dissolved in sample, ppm
x = percentage saturation

The upper index line connects 764 mm on the P-scale with 18° on the t-scale and shows on the S-scale that the solubility of oxygen in water under these conditions is 9.6 ppm. The lower index line connects 9.6 on the S-scale with 6.0 on the σ-scale and shows on the x-scale that the water is 63 per cent saturated with oxygen.



Water Works Practice Finds New and Varied Uses for . . .

Polyphosphate Treatment

by DAVIS E. SPEEG, Chemical Engineer
Coastal Engineering Corp., New Orleans, La.

EDITOR'S NOTE: The use of polyphosphates in water conditioning is relatively in its infancy. The author endeavors to trace the history in the use of these chemicals from the time of initial discovery up to the present day applications.

Some of the many varied uses for the hexametaphosphates are discussed. The properties displayed with each use are given limited explanation. The article is designed to provide the reader with a broader insight and a better understanding of the qualities and applications for the hexametaphosphates.

■ IN 1833, THOMAS GRAHAM, a British chemist and the founder of the field of colloidal chemistry, discovered a new form of phosphate which he called sodium metaphosphate, one of the polyphosphates. It was known as Graham's salt for many years; and during the next eighty years, this chemical was confined to laboratory use. In 1929, Dr. Hall, of Hall Laboratories, and his co-worker, Mr. Jackson, first produced and used the sodium hexametaphosphate commercially for boiler water conditioning. Dr. Hall announced his discovery in 1932 of its properties of softening water without precipitation and without the removal of the hardness constituents. This led to a very intensive study of the metaphosphates and the properties of what later came to be known as the *Cinderella of the phosphates*.

It might be well to describe exactly what the polyphosphate is. By Webster's definition, *poly* is "a combining form meaning many or much; consisting of many; several; or more than the normal." You could more easily define polyphosphate by saying that it has by its nature, characteristics and chemical composition, or structural form, other than what is commonly known by the chemist as the normal phosphates, or orthophosphates. There is a pamphlet, "The Peculiar Phosphates—Some Suggestions Concerning Nomenclature," by Dr. E. P. Partridge of Hall Laboratories, that fully describes, as he terms it, this metaphosphate muddle.

Probably the most widely used polyphosphate today for water treating is the sodium hexametaphosphate. Therefore, an attempt will be made to list here some of the virtues, characteristics, and applications of this phosphate. Most of the literature research has been obtained from the files of Hall Laboratories and Calgon Company. "Calgon" is a trade name for a food grade hexametaphosphate.

Before discussing the properties of sodium hexametaphosphate, particular attention is directed to the exact control conditions, as regard pH and concentration, that are required to attain the optimum effects and results from the use of hexametaphosphate. This material is certainly not a cure-all, nor is it advertised as such. It does have properties, however, that make its application very attractive to many conditions that exist in the municipal water treating field. The useful life of sodium hexametaphosphate is a function of time, temperature, and pH. A technical bulletin entitled, "The Useful Life of Pyro, Meta, and Tetra Phosphates," by Morgen and Swoope, University of Florida, gives a full description of the useful life of these phosphates. With respect to its chemical and physical acting properties, sodium hexametaphosphate has two properties:

1. A definite surface active property at the solid aequeous innerfaces.
2. The property of forming soluble complexes with multi-valent cations, thereby removing them from their normal chemical action, appearance, or function.

By these two chemical and physical characteristics, the following properties of sodium hexametaphosphate may be applicable to the municipal field—namely:

1. Dispersion.
2. Threshold Application.
3. Sequestration.
4. Affinity for the Formation of Metal Complexes.

Each of these will be discussed individually.

Dispersion

A dispersion signifies the state of suspension of finely divided particles in some other substance. By Webster's definition, to disperse means "to break apart and go different ways; to scatter or to cause to become widely separated." Some common dispersions are paints, certain textile coatings, milk of magnesia, laundry starch, mayonnaise, and more common to us, oil well drilling muds. It has been found that by the application of sodium hexametaphosphate at a concentration of 2,000 to 4,000 mg/L, you

are able to widely disperse most substances found in fresh water wells. Sodium hexametaphosphate has been widely marketed to restore the capacity of water wells. In essence, what this hexametaphosphate does is to disperse and lift to the surface fine silt and iron deposits commonly found in wells. Most of the well drillers, as well as many of the municipal superintendents, in the nation use this material to restore wells.

Hexametaphosphate is used, also, as a dispersive for treatment of drilling muds for oil production. This was particularly true several years ago, prior to the advocation of the high pH muds and before the extreme depths that are being drilled today. It can be well appreciated that with the increased depth there is also an increase in temperature. The reversion of the metaphosphate in the presence of the high pH and high temperature make its useful life very short. It is used very widely today, however, for the *surface hole*.

The cleaning of zeolite and all purpose filters with sodium hexametaphosphate is quite common. This application would be one of dispersive. Some of the zeolites and filters become coated with "mud balls" or amorphous precipitants of iron. These may be easily dispersed, broken up, and removed from the beds, giving a very effectively cleaned resin or filter bed. It is not, however, advocated to use sodium hexametaphosphate to use this method to cleanse filters that are coated with a calcium carbonate precipitant. It is known, however, that the sodium hexametaphosphate will prevent this precipitation under different concentrations and control conditions.

Threshold Application

The properties of threshold application of sodium hexametaphosphate to the municipal field are oftentimes misleading and misconstrued. The threshold application as pertains to scale prevention is the application of 1-2 mg/L of hexametaphosphate to a scaling water, thereby preventing the crystalline growth of calcium carbonate particles to build scale. Growth of this nature also occurs very often on filter sand and is commonly referred to as filter growth. The sharp edges of the filter sand are coated with the deposit, thereby reducing the filtering efficiency of the bed.

The threshold application of CALGON in red water removal is really the same application of hexametaphosphate involving the ions of iron and manganese instead of calcium. Quite often, however, in a low pH water dissolved iron will be present. As soon as this is exposed to air or chlorine, the iron will precipitate, forming a so-called red water. These waters are normally high in carbon dioxide and are very corrosive by nature. The application of a hexametaphosphate in a magnitude of 2-4 mg/L for each mg/L of dissolved iron can prevent this red water appearance. In essence, what has been accomplished is the precipitated iron particle is prevented from growing, so to speak. The iron will not precipitate visually. The test can be made for the iron, and will be found to be present. However, its character of red water will be eliminated. Hexametaphosphate in the system also will form a protective film in the pipeline, thereby preventing the further dissolving of iron by setting down a protective phosphate film. This application is a property to be described later. Most of the applications depend upon the individual problems of water supply. The control conditions for each application are as follows:

1. Scale Prevention: 1-2 mg/L hexametaphosphate applied to the effluent of the clarifier to attain maximum protection, i.e., the filter bed as well as the lines and valves.

2. Iron and Manganese Stabilization: 2-4 mg/L hexametaphosphate for each ppm of iron. If manganese is present, lend toward the high dosages. It is imperative that the hexametaphosphate be added *before* any chlorine is added and prior to being exposed to the atmosphere. The oxygen and the chlorine would both oxidize the iron, causing it to precipitate. The hexametaphosphate would be of little use at this stage of application.

Sequestration

The term *sequestration* means "the act of retiring, secluding, or withdrawing; the act of taking possession of or confiscating." To sequester would be to remove certain properties that would normally exist. To a chemist, the application of hexametaphosphate for sequestration would be known as a stoichiometric reaction. In other words, the amount of hexametaphosphate needed would be directly proportioned to the amount of metallic ion present in the existing system. This application in municipal fields is pertinent primarily to those where the hard water is completely softened by sequestration—such as, laundering. This property would, also, apply to those municipalities that are engaged in operating boilers for the production of steam. The phosphate ion in this instance ties up the calcium and magnesium ion, rendering them relatively inactive insofar as forming scales of silicate, sulphate, or carbonate. This property may be easily demonstrated, and quite effectively, by taking a garment that has been washed, rinsed and dried, and rinse it again in a water that has a high concentration of sodium hexametaphosphate. It will be noted immediately that a sudsing action will appear. This is because the precipitated soap scum that is prevalent in all washes redissolves in the hexametaphosphate treated rinse water.

The properties of sequestration are, also, carried into the industrial field. Sodium hexametaphosphate exercises a peptizing effect and dispersing action on many heavy metals and oxides. In the dyeing of papers and cloths, it is very important that the dye water be calcium and magnesium free. Hexametaphosphate is used to sequester any possible calcium and magnesium ions that might find their way into the system. The same is true for the textile industry. The leather tanning industry was greatly revolutionized with the increased rate of penetration of tannins into leather through the use of hexametaphosphates.

Affinity for the Formation of Metal Complexes

This property of hexametaphosphate falls under two categories:

1. The Treshold Application for Corrosion Control, which is the formation of an iron metaphosphate film barrier, is applicable when metaphosphate is applied at the rate of 2-4 mg/L under pH controls of above 7.0. This is commonly known

as the threshold range for corrosion control. The application has been recently supplemented by new and better methods of protection.

2. THE AFFINITY FOR METAL PROTECTION is much more effective in what is called the low pH-high metaphosphate range. This is where the pH of a water system is dropped to 6.0-7.0 and a metaphosphate residual of 10-15 mg/L is maintained. This application of metaphosphate is rare among most municipal operators except those operating power plants where cooling towers are involved. It is in common use at industrial plants, such as refineries and chemical plants where large cooling towers are operated. It has been found to be one of the most effective methods of protecting ferrous systems where scale-forming waters are used.

New Advancement in Polyphosphate

There have been two very recent advancements in the use of polyphosphate. The most recent advancement is probably the Calgon TG. This is like standard Calgon in that it is a colorless glass platelet, but instead of a straight sodium hexametaphosphate, it is now a sodium zinc hexametaphosphate. It has some decided advantages over standard sodium hexametaphosphate in that it has:

1. More rapid film formation.
2. More efficient corrosion protection.
3. Less reversion.
4. Ease of feeding.

Many waters of various types have a much more rapid film formation with the Calgon TG, due to the synergistic effect from the presence of zinc. A more efficient corrosion protection is attained due to the formation of a tougher film which is set down more quickly. This means that superior results can be obtained at an equal rate of feed or possibly even at 30-40 per cent reduction in the rate of feed. Since the metaphosphate is really the active character in this treatment, the effective treatment can be prolonged by reducing the reversion rate. Calgon TG is very effective at municipal water works where a fast film formation is desired, particularly after main line cleaning, or in very corrosive waters such as those extremely high in carbon dioxide.

Another recent advancement in the use of polyphosphate for water treating is what one company has termed *controlled solubility*. The feeding of metaphosphate in many installations does present a problem. Some want a very highly soluble material such as straight sodium hexametaphosphate, whereas others wish a material of a slow-dissolving character that can be suspended from cooling towers, basins, or fed through various pot type feeders—with the intent to charge baskets and pot feeders every two weeks or even as much as once per month or once per season. Each of these materials is marketed under various trade names, such as Calgon 15-J, Micromet, and so forth each designating a "half-life" or "quarter life" solubility, meaning that for a pre-determined time one-quarter of the charge will be dissolved or one-half of the charge will be dissolved. In essence, it is merely a feeding method for the same familiar *Cinderella phosphates*, the hexametaphosphates. The application of these controlled soluble hexametaphosphates varies from the cooling towers atop office buildings to the fracturing of sands thousands of feet into the earth.

More recent advances in the use of polyphosphate, and here again water is involved, is found in the use of sodium hexametaphosphate in the meat packing industry. This Cinderella of the phosphates has allowed the packer to produce hams of higher yield weights, redder color, tastier, with shorter cook-out time; and in the production of bologna, the reduction of "fat-capping" has been tremendous. Some of the new advancements in polyphosphate usage have been extended to the canneries and preserving industries. In the preserving industry, the color retention of fruit has been greatly preserved. The browning of fruit, such as peaches, has been attained. In the canning industry, the color retention of green vegetables has been improved, as well as the shrinkage of things such as peas and beans. This is achieved by the sequestration of the calcium ion which does cause a shrinking in peas, as well as the stabilizing of iron, which would cause discoloration.

It should be emphasized that hexametaphosphate is not a cure-all but by the application of the three mentioned properties, it can be used to attain remarkable results that oftentimes seem to be insurmountable. Although the properties above described have been proven many times, hexametaphosphates should only be applied under controlled conditions if the optimum results are to be attained. There are exceptions to each property. Therefore, the use of this material should be evaluated by technical people versed in its applications and the indiscriminate use of hexametaphosphate should be avoided.

Synthetic Detergents and Emulsifiers

is a 78-page bound reprint of an article which appeared in the December 1957, January, February, March and April 1958, issues of *Soap and Sanitary Chemicals* magazine under the title "Surfactants Listed" by John W. McCutcheon. The first two pages of the reprint are devoted to a general summary of the synthetic detergent field and its most recent developments. This is followed by seventy-five pages of tables which list alphabetically over 2000 U. S. trade name products together with manufacturer, class and formula, main use, form, per cent concentration, type and further remarks. About 250 manufacturers whose products are given, are listed in the Appendix. The reprint may be purchased for $2.50 per copy from John W. McCutcheon, Inc., 475 Fifth Avenue, New York 17, N. Y.

"Cooperation pays off. Even freckles would make a good coat of tan if they could get together."

N. M. deJarnette,

of the Georgia State Health Department writes: "Re: Thatcher's problem with well water turning whiskey black—page 221 your May issue—when we have this complaint we require samples of the whiskey (at least a quart), not the water. Any old ink maker will tell you the water contained iron and chances are that was fairly good whiskey which had been aged in oak barrels. If he will send us two "fifths" we will have it checked."

Reasons for earlier failures, new type materials, and selection guides are presented in this report on

Plastic Pipe for Water Distribution

by H. M. McDANIEL, Assistant Manager, Sales, Pipe Division, Republic Steel Corp., Cleveland, Ohio.

ED. NOTE: This report is an excerpt of a paper presented by Mr. McDaniel at the North Central Section Meeting AWWA, and is published here by permission.

■ IN ONE WAY or another, everyone has been made aware of the existence of plastic pipe, a commodity which, for the past several years, has been making a place for itself. Plastic pipe today has become the standard method of removing corrosive ground waters from mines due to its extreme resistance to deterioration from corrosive waters and aggressive soil conditions. As a matter of fact, the first major use of plastic pipe was in mines and there it has proved itself for the past ten years.

Variety of Applications

For rural water systems plastic pipe has practically replaced other materials except where extreme setting depths or pressures are involved.

Flexible polyethylene has been the principal pipe used in such systems, but recent developments point out the many advantages of using semi-rigid plastic pipe instead. ½, ¾ and 1 horsepower submersible pumps have been set as deep as 200 feet using semi-rigid Kralastic pipe. Multi-stage jet pumps as deep as 250 feet using semi-rigid material supplied in 20-foot lengths and joined by solvent welding. Here again, the ability of plastic pipe to stand up in corrosive waters, the elimination of scale buildup and rust deposits, as well as the freedom from electrolytic action, have been the principal reasons for the use of plastic pipe. In addition, the economy afforded by long lengths and quick and easy methods of joining have added the all important advantage of economy.

The gas industry has used sizable quantities of plastic pipe principally for service lines. The same advantages found by other industries dictate the use of plastic pipe by this important pipe user.

The Metropolitan Sanitary District of Greater Chicago has been conducting tests with semi-rigid plastic pipe since 1948. The pipe carries ferric chloride used in converting wastes into fertilizer. Several cities have used plastic pipe in their rotary filters in sewage treatment works. Another advantage found here is the resistance of plastic pipe to abrasion from sludge solids.

Semi-rigid plastic pipe has also been widely used for golf course sprinkler systems, perhaps the largest of these being a 33-mile plastic pipe installation in a city owned golf club in San Diego, California.

The oil industry has afforded a tough proving ground for plastic pipe due to the extremely corrosive crudes, salt water and gases found in such operations. In many cases the soil is also corrosive so that both internal and external corrosive agents are present, but over 1500 miles of plastic pipe in such installations dating back for a period of six years has proved the ability of plastic pipe to deliver the goods when used within the pressure and temperature limitations of the raw materials.

One of the most interesting and impressive uses of plastic pipe involves the use of over 3500 miles of Kralastic pipe in the West Texas area for conveying natural gas to operate irrigation pumps. These installations began something over four years ago and are performing with complete satisfaction.

Toxic Tests by NSF

In regard to the use of plastic pipe in water distribution systems, one of the first questions asked of plastic pipe was, is it safe from a health standpoint? To answer this problem, the plastic pipe industry went to the National Sanitation Foundation, a nonprofit corporation set up for research and education in environmental sciences in the interest of public health. This foundation is headquartered at the School of Public Health, University of Michigan, Ann Arbor, Michigan. This organization was created in 1944 by a small group of industrial public health leaders who were interested in mutual problems involving sanitation.

This group devoted over four years to the development of a testing program for plastic pipe and the actual carrying out of the testing procedure. In their laboratories samples of plastic pipe were thoroughly tested under all conceivable conditions to determine which of the chemical compositions of the various plastic pipes would be non-toxic and safe for transporting drinking water under any conditions without any danger of importing objectionable taste or odor. The tests were designed to determine any effect of plastic pipe upon the safety and desirability of potable water as well as the effects of the water on the pipe. They included air, water and soil con-

tact effects, as well as the toxicological aspects. Also included were the practicability of disinfection procedures, extraction studies, tests of taste and smell, and the effect of plastic pipe on chlorine residuals in tap water, as well as the effect of high concentrations of chlorine on plastic pipe. The result of the four years of intensive research on plastic pipe have been made public and an educational program is now going forward backed by the producers of plastic pipe and plastic raw materials. The results of these tests clearly demonstrate that only in pipe approved by NSF can one be certain of safe transportation of drinking water without danger of imparting objectionable taste or odor. "A Study of Plastic Pipe For Potable Water Supply," is the title of the foundation's report.

After this study was completed the materials which passed this long testing program were approved for the production of plastic pipe. Manufacturers using such material must open their plants to inspection by officers of the National Sanitation Foundation. Samples of approved pipe for inspection may be obtained at any time. These tests are conducted no less than once a year and upon completion of a satisfactory examination, plastic pipe producers are qualified to use the seal of approval of the National Sanitation Foundation on pipe made from approved materials.

Earlier Installations

For water distribution systems the physical characteristics of the plastic material must be considered. In other words, a pipe to be suitable, must also be able to withstand the pressures and temperatures involved in the systems operations and must be economical as well. It must be able to be joined to existing materials.

One of the first materials available in plastic pipe to find any appreciable volume was polyethylene. Polyethylene is a material of relatively low tensile strength and, unfortunately, many early installations of polyethylene pipe proved to be rather disheartening. To begin with, in the early days of the manufacture of polyethylene pipe, the proper sources of raw material were not available due to the considerably greater demand than supply for the raw material. The result was that manufacturers used any material which became available whether it was new prime material from a raw material supplier, or whether it was reprocessed and reworked scrap. Many of the early pinhole failures of polyethylene pipe can be attributed to the use of improper material. This was certainly no fault of the plastic pipe supplier because, after all, those were days of the very beginning of a tremendous new industry and many things can be learned only through experience. As the supply of polyethylene increased and as manufacturers had an opportunity to put new clean material into pipe, fewer failures resulted. At the same time, the plastic pipe industry was learning that perhaps the original expectations for the pressure carrying capacity of polyethylene were a little too optimistic. Consequently, lower pressure ratings were suggested as time and experience dictated.

Fittings were a problem in the early days and some of the early insert fittings made of styrene failed in cold weather and under any abnormal abuse. Metal fittings soon came into being, as well as plastic fittings made of tougher and more rugged materials. Today the plastic pipe industry offers insert fittings made of nylon. Such fittings will withstand more abuse than even metal fittings and are coming into wide use where long life and economy are important factors. Fittings of almost any description are available today, and it is safe to say they are greatly improved over the early plastic fittings which were rather limited in their scope.

But polyethylene even under the best conditions quite often is not

EASY JOINTING of plastic pipe effects economies in installation costs.

enough for a water distribution system. The walls can be beefed up to give higher pressure ratings but then clamping of the pipe around the fittings becomes a problem and obviously the price goes up. It should not be infered that polyethylene is out of date because tremendous strides are being made in improving polyethylene as a pipe material. New polyethylenes are in production now with twice the strength of the conventional type. However, these materials are obviously more rigid and consequently the present method of joining polyethylene is something less than satisfactory. It is rather difficult to clamp a material of greater stiffness than our conventional materials. Polyethylene does not lend itself to solvent welding and while various means such as heat welding have been explored, they do not seem to be perefcted to the point where a fool-proof method of joining is available in these newer materials.

New Materials

However, there are available semi-rigid plastic materials such as Kralastic, a styrene acrylonitrile material. This material has been giving exceedingly good service in water distribution systems. This is the same material which has proved itself in over 6000 miles of plastic pipe in the oil and gas industry and related industrial uses. This is the same pipe which has been used widely for hundreds of golf course irrigation systems. At the present Kralastic pipe is used in over fifty water distribution systems. These systems are not 100 per cent Kralastic, but it is being used to varying degrees for service lines and for small main extension. The city of Dallas, Texas has been testing Kralastic pipe for their municipal water system for about four years and sizable quantities are now in use. From a strength standpoint Kralastic pipe offers more strength for the money than any other type of plastic pipe. Kralastic solvent welds quickly and strongly, affording considerable economy in installation costs. A wide range of socket type fittings are available for almost any type of connection. Kralastic is extremely light weight and highly corrosion resistant. It has a good history in various field applications. It has been approved by the National Sanitation Foundation as safe for handling potable waters.

The plastic pipe industry produces Kralastic pipe in a variety of pressure rated schedules as well as in Schedule 40 and Schedule 80 iron pipe sizes. How much of an inroad plastic pipe will make in the water-works field in the next ten years is anybody's guess. If the strength of plastic pipe is doubled in the next few years without any increase in cost of raw material, there would undoubtedly follow a greater interest in this new product. Some materials having such properties are in the laboratory stages right now. However, one can't sit still today and wait for a gold-plated cadillac of tomorrow.

Materials Currently Available

Available today is a material which will do the job required and at the same time afford a savings over present materials. Rapid expansion programs, which include a swirl of rising costs of labor and materials, should provide an ideal time to look at what plastic pipe may offer. For example, there is available Kralastic pipe of various pressure ratings ranging from 100 lbs upward. If the service lines are 1" 100-lb Kralastic pipe is available for under 14c a foot and 1" 150-lb pipe for something under 16c a foot. If higher pressures are to be encountered 1" Schedule 40 pipe rated at 240 lbs continuous working pressure is available at about 32c a foot and 1" Schedule 80 pipe rated at 325 lbs continuous working pressure is available at 41c a foot. These prices are for small quantity purchases and volume purchases can afford a savings beyond these prices. Compare these figures with some of the present costs. Take into account that a considerable savings can result from the ease of joining.

Working Pressures

Regarding working pressures and the term "continuous working pressures," the plastic pipe industry rates its pipe at a standard temperature of approximately 75° F. As higher temperatures are encountered the pressure rating would become less. For lower temperatures the pressure rating would go up. This is the nature of plastic materials. However, a rating at 75° F should meet the maximum temperatures encountered in buried water distribution systems and any lower temperatures would be on the safe side. The term "continuous working pressure" means a sustained, more or less constant pressure, a condition considerably different from that encountered in water distribution. While the pipe has an adequate safety factor to carry temporary surges of considerably higher than its pressure rating, it is recommended that a pipe be selected that will allow for additional safety. A pipe having approximately 40 per cent greater strength than the maximum conditions which you would expect to encounter in your particular system is recommended. For example, if you normally operate at 60 lbs pressure, 100-lb pipe should be adequate; but if the operation is in the neighborhood of 100- to 110-lbs, 150 lb pipe would be indicated.

Causes of Earlier Failures

There have been reports made of the use of plastic pipe in water distribution systems in which numerous failures have been pointed out. These reports, almost without exception, pointed out that the pipe selected did not necessarily have the proper pressure rating for their particular use. In the early stages of plastic pipe, the industry was a little too optimistic about the working pressures for the various materials. Now more conservative figures have become industry standards. It was also pointed out in these reports that in many cases copper tubing sizes were selected in plastic pipe. Without attempting to be critical, it should be pointed out that there is no more reason why plastic pipe should be produced in copper tubing sizes than there is in producing copper tubular products in iron pipe sizes. One most look at the job to be done and select the proper schedule, wall thickness, etc. to do the job based on the physical properties of the particular material involved.

Today, the plastic pipe industry offers the water plant: economy; extreme corrosion resistance in handling aggressive waters as well as chemicals; complete freedom from electrolytic corrosion resulting in lower maintenance costs; and simple installation.

The editor's comments

How to Run a Meeting

In October, I had the pleasure of attending the annual meeting of the Pennsylvania Water Works Assn. I was particularly intrigued with two large printed signs, one at the registration desk, the other just outside the meeting room. Both read —

All sessions will begin and end at the exact times set forth in the printed programs. All speakers will begin and end presentations at fixed times. — And they did!

Now, that's the way to run a technical meeting and John H. Murdoch, Jr., long time president of that association of private water companies, deserves all the accolades that were tendered him. Not only is he a fine speaker, an excellent phrase maker, and an able consultant on water works management, but he is also an expert when it comes to presiding at meetings where papers are presented.

At Purdue University, Prof. Don E. Bloodgood, has run a three ring circus at the annual Industrial Waste Conference. He has kept as many as four concurrent sessions on strict schedule. There are probably others who do as well, but they are all too few. If John Murdoch and Don Bloodgood can make audiences and speakers adhere to the scheduled times printed on the program, then surely this practice can become standard for all organizations. I invite all our readers to join me in a crusade to improve meeting program schedules.

FSIWA Moves Forward

1. Early this year, I commented on the action of the Indiana members of the Central States Sewage & Industrial Wastes Assn., who had voted to withdraw from the Central States group and to petition the Federation for full membership as the Indiana Sew. & Ind. Wastes Assn. During the course of the year, the Central States Assn. revised its constitution to exclude Indiana and the Indiana group drew its own constitution.

At the Federation Board of Control meeting in Detroit, both of these constitutions were approved. On Nov. 1, 1958, the Indiana Sewage and Industrial Wastes Assn. became the newest member of the Federation. I believe that both the Indiana Assn. and the remaining Central States Assn. will benefit and grow as a result.

2. That the Federation would have to raise its dues was inevitable. The Federation is growing up; it is now 18 years since it reorganized and became more than just a Journal publishing organization. The publication of the Journal still remains an important activity, but desirable services to individual members and public relations programs for the entire field can be handled only by a central office of some size. Costs of publishing the Journal have grown during the past year and will continue to grow. If additional services are to be provided to the members, there must be additional expenses to operate the Federation office.

It is to the credit of the Federation Board of Control that it met this problem squarely and decided first, to resort to deficit financing out of reserves to meet expenses in 1959 and to raise the dues from $5 to $8 a year for active members, effective on Jan. 1, 1960. Advertising rates in the Journal will be increased in Jan. 1960.

3. Another Federation Board action, of interest, was the appointment of a special committee to study suggestions for a possible change in the name of the Federation. The committee will present its recommendations to the Board for action at its October 1959 meeting in Dallas. Of some thirty suggestions already made, one seems to have elicited interest among a number of persons, it is: "Wastewater Technology Federation."

One Field—Two Phases

This magazine has always been interested in both water supply and sewage disposal and has taken the position that these are but two phases of one field. There are so many factors common to both water supply and sewage disposal that we believe it is a good and sound policy to cover both of these phases in a single magazine.

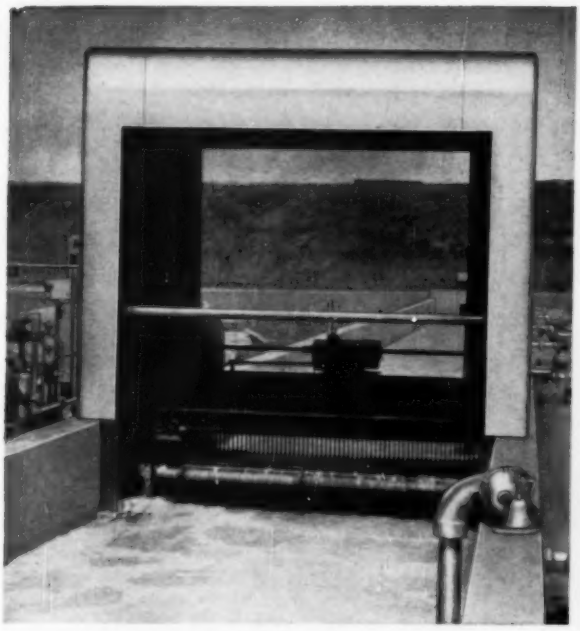
As is well known, almost all consulting engineers in the field of sanitary engineering work in both areas of the field, that is in both water supply and sewage disposal. It is equally well known that all state sanitary engineering departments and the U. S. Public Health Service include both water supply and sewage disposal under their jurisdiction.

Information collected from all over the country has shown that there has been a growing tendency for municipalities to place both water supply and sewage disposal under a single department or single manager.

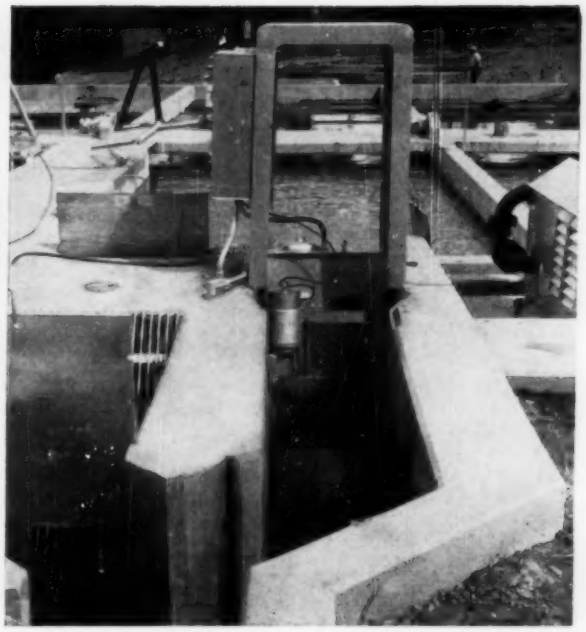
Recently, an interesting corollary of this trend came to my attention. The Florida Sect. AWWA and the Florida Sewage & Industrial Wastes Assn. met jointly for the ninth time. In Florida, too, there is a Water and Sewage Works Operators Association that has a membership of more than 400. There are several other locations where joint meetings are held.

It was reported at the Federation meeting in Detroit, that in 19 of the 32 states having training programs for sewage works operators, the training program is a joint one for water and sewage works operators; another evidence of the oneness of the field which this magazine covers.

George E. Symons.



Model "A" BARMINUTOR® Screening and Comminuting Machine . . . for use in rectangular channel sections 4 to 12 feet wide . . . sized for flows of 10 MGD and upwards.



Model "B" BARMINUTOR® Screening and Comminuting Machine . . . for use in rectangular channel sections 1 to 3 feet wide . . . sized for flows of .09 to 15 MGD.

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"Chicago" COMMINUTOR Screening and Comminuting Machine . . . for use in hydraulically designed feeder basin . . . sized for flows of .175 to 25 MGD per machine.

A Development of More Than 25 Years Successful Comminutor Experience

The BARMINUTOR® Screening and Comminuting Machine provides continuous, complete, automatic comminution . . . at lower operating and maintenance cost than any similar device available today.

The BARMINUTOR® was developed to provide greater flexibility and wide application of comminution . . . developed from the original "Chicago" COMMINUTOR, proven highly successful in thousands of installations.

BARMINUTOR® Screening and Comminuting Machines eliminate unsightliness, nuisance and odor by continuously and automatically screening and cutting coarse sewage material without removal from the flow. Power requirements are lower than that required for mechanically raised screens and grinders. Manual attention is needed only for periodic inspection and lubrication.

Complete details are available from Chicago Pump Company Distributors located in most principal cities.

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FOOD MACHINERY AND CHEMICAL CORPORATION

Chicago Pump Company

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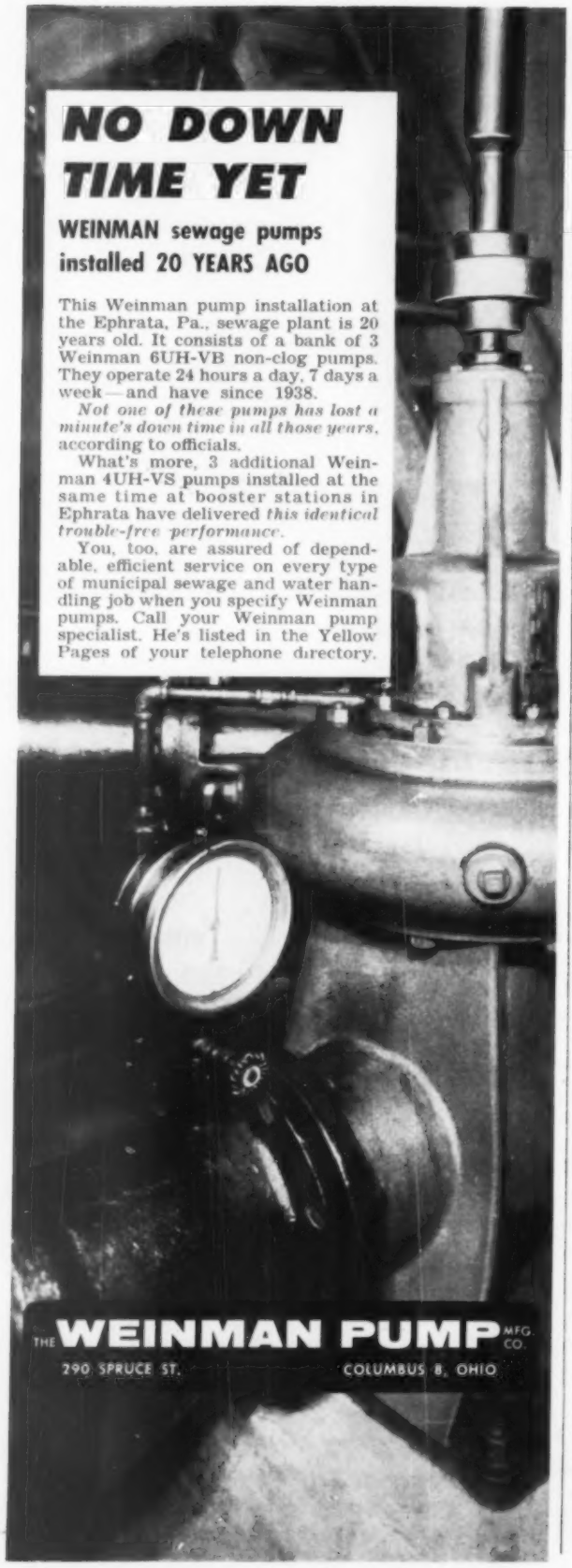
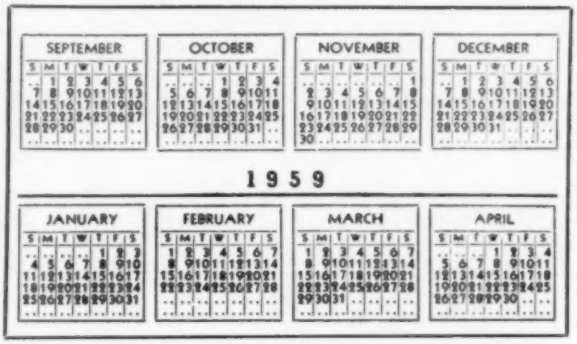

NO DOWN TIME YET
WEINMAN sewage pumps installed 20 YEARS AGO
This Weinman pump installation at the Ephrata, Pa., sewage plant is 20 years old. It consists of a bank of 3 Weinman 6UH-VB non-clog pumps. They operate 24 hours a day, 7 days a week—and have since 1938.
Not one of these pumps has lost a minute's down time in all those years, according to officials.
What's more, 3 additional Weinman 4UH-VS pumps installed at the same time at booster stations in Ephrata have delivered this identical trouble-free performance.
You, too, are assured of dependable, efficient service on every type of municipal sewage and water handling job when you specify Weinman pumps. Call your Weinman pump specialist. He's listed in the Yellow Pages of your telephone directory.
THE WEINMAN PUMP MFG. CO.
290 SPRUCE ST.
COLUMBUS 8, OHIO

Meetings

1958



Dec. 7-10—Cincinnati, Ohio *(Netherland Plaza Hotel)*
AMERICAN INSTITUTE OF CHEMICAL ENGINEERS, Annual Meeting, Secy., F. J. Van Antwerpen, 25 W. 45th St., New York 36, N. Y.

Dec. 11—Biddeford, Maine
MAINE WATER UTILITIES ASSN., Secy., Gerard F. Laurin, 89 Western Ave., Augusta, Maine

Dec. 12-13—Minneapolis, Minn. *(Univ. of Minnesota)*
FIFTH ANNUAL WASTES ENGINEERING CONF., Merrill C. Cragun, Course Coordinator, c/o Director, Center for Continuation Study, Univ. of Minn., Minneapolis 14, Minn.

Dec. 18—Boston, Mass. *(Hotel Statler)*
NEW ENGLAND WATER WORKS ASSN., Secy., Joseph C. Knox, 73 Tremont St., Boston 8, Mass.

1959

Jan. 22-23—New York, N. Y. *(Park-Sheraton Hotel)*
NEW YORK SEWAGE & INDUSTRIAL WASTES ASSN., Exec. Secy., Ralph C. Sweeney, State Dept. of Health, 55 Church St., White Plains, N. Y.

Jan. 27—New York, N. Y. *(Park-Sheraton Hotel)*
NEW YORK SECTION, A.W.W.A., Mid-winter Luncheon, Secy., Kimball Blanchard, 19 West 50th St., New York 20, N. Y.

Feb. 4-6—Indianapolis, Ind. *(Sheraton Hotel)*
INDIANA SECTION, A.W.W.A., Secy., Chester H. Canham, State Bd. of Health, 1330 West Michigan St., Indianapolis 7, Ind.

Feb. 9-13—Los Angeles, Calif. *(Hotel Statler)*
AMERICAN SOCIETY OF CIVIL ENGINEERS, Exec. Secy., W. H. Wisely, 33 W. 39th Street, New York 18, N. Y.

Feb. 11-12—Portland, Maine
MAINE WATER UTILITIES ASSN., Secy. Gerard F. Laurin, 89 Western Ave., Augusta, Maine

Mar. 2-6—College Station, Texas *(A & M College)*
TEXAS WATER & SEWAGE WORKS ASSN., Annual Short School, Secy., V. M. Ehlers, 2202 Indian Trail, Austin 3, Texas

Mar. 11-13—Chicago, Ill. *(Morrison Hotel)*
ILLINOIS SECTION, A.W.W.A., Secy., Dewey W. Johnson, Cast Iron Pipe Research Assn., Suite 3440 Prudential Plaza, Chicago 1, Ill.

Mar. 11-13—Atlantic City, N. J. *(Traymore Hotel)*
NEW JERSEY SEWAGE & INDUSTRIAL WASTES ASSN., Secy., Anthony T. Leahey, P. O. Box 32, West Trenton 8, N. J.

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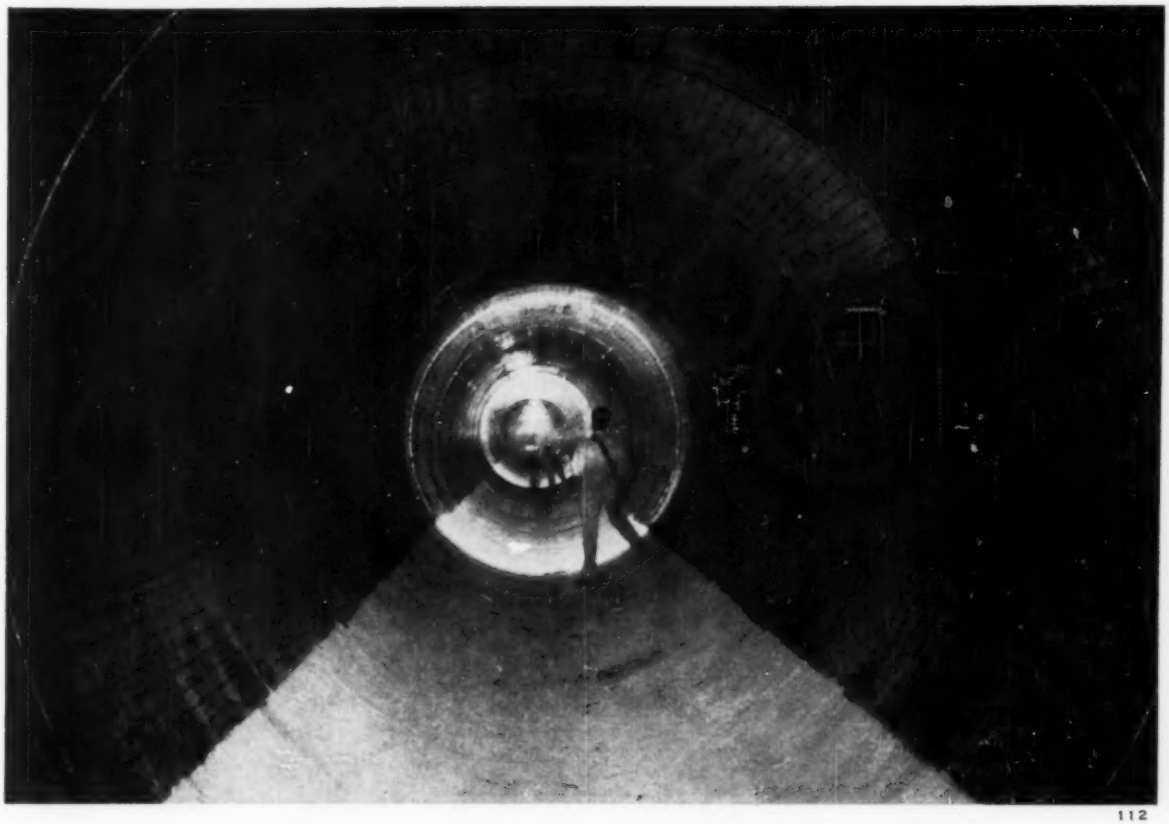

112

This Sewer will go a Long Way

Not only will this 9½-foot outfall sewer extend eight miles, but it will go a long way in years of trouble-free service. The engineers who designed it say that it will still be functioning perfectly in the year 2000.

Their confidence is based on wise choice of construction materials. Every joint of pipe, every foot of monolithic tunnel, every structure is built of reinforced concrete to obtain structural strength at low cost. Every surface above the low flow line is completely covered by a continuous membrane of T-Lock Amer-Plate®, the vinyl lining that is impervious to the corrosive action of oxidized hydrogen sulfide *at any level of concentration.*

The engineers know that no one can accurately predict future rates of H_2S gas generation, so they have insured the ultimate life of the concrete by investing an extra 8 to 10% for T-Lock protection. They predict that this "extra" will spare their city the cost of a replacement sewer in about 20 years, and *save the taxpayers millions of dollars!*

Because of obvious and substantial savings such as this, millions of square feet of T-Lock are now in use in progressive municipalities from coast to coast. These include Los Angeles; Topeka; Wichita; Sioux Falls; Shreveport; Washington, D.C.; San Diego; Mansfield, Ohio; Huntington, W.Va.; Hutchinson, Kan.; and Orange County, Calif. T-Lock Amer-Plate is also on current specifications for many other municipalities. For complete list of users and specifiers, plus technical data and a typical specification, write:

Amercoat® CORPORATION

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4809 Firestone Blvd.
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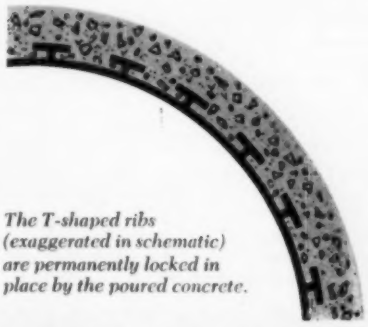
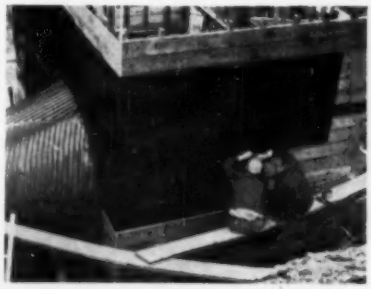
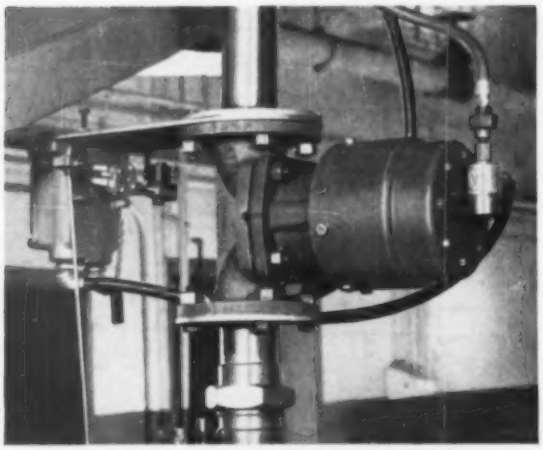


The T-shaped ribs (exaggerated in schematic) are permanently locked in place by the poured concrete.



There is no limitation on size or shape of structures which may be protected with T-Lock Amer-Plate.



MANPOWER COSTS CUT 50% with power-operated GRINNELL-SAUNDERS DIAPHRAGM VALVES

A *single* stainless steel Grinnell-Saunders Valve, with neoprene diaphragm, made this profitable difference at a leading West Coast processing company. Automated by Bendix-Westinghouse topworks, the valve completes one full cycle every 5 seconds, 8 hours a day, 5 days a week — at 190°F.

Grinnell-Saunders Diaphragm Valves may be easily equipped for automatic operation — by combining any one of a number of power operators, a sliding stem bonnet assembly, and valve body.

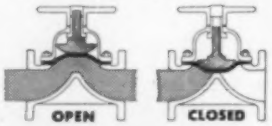
The operating principle of the valve is simple. The resilient, flexible diaphragm lifts high when the compressor is raised — seals tight against the body weir when compressor is lowered. Closure is positive, even should grit, pipe scale or other solid matter be trapped on the weir.

Grinnell-Saunders Diaphragm Valves are unsurpassed for handling materials as diversified as corrosive fluids, gases, beverages, foods . . . in lines where corrosion, abrasion, contamination, clogging, leakage and maintenance are costly factors.

Grinnell valves are available with body, lining and diaphragm materials to meet different service conditions. Write for details.

FEATURES OF GRINNELL-SAUNDERS DIAPHRAGM VALVES:

- Diaphragm lifts high for streamline flow in either direction . . . completely isolates working mechanism from fluid stream.
- Resilient diaphragm assures positive closure.
- Body, lining and other diaphragm materials to suit service conditions.
- Simple maintenance. Diaphragm can be replaced easily without removing valve.



GRINNELL

WHENEVER PIPING IS INVOLVED

Executive Offices: Providence, R. I. Sales Offices and Warehouses in Principal Cities

Mar. 16-18—Little Rock, Ark. *(Marion Hotel)*
ARKANSAS WATER & SEWAGE CONF., C. W. Oxford, Univ. of Arkansas, Fayetteville, Ark.

Mar. 19—Boston, Mass. *(Statler Hotel)*
NEW ENGLAND SECTION, A.W.W.A., Secy., J. E. Revelle, Chicago Bridge & Iron Co., 201 Devonshire St., Boston 10, Mass.

Apr. 2-3—Chapel Hill, N. C. *(Univ. of North Carolina)*
EIGHTH SOUTHERN MUNICIPAL & IND. WASTE CONF., Prof. Dan A. Okun, Univ. of North Carolina, Chapel Hill, N. C.

Apr. 5-8—Columbia, S. C. *(Wade-Hampton Hotel)*
SOUTHEASTERN SECTION, A.W.W.A., Secy., N. M. de Jarnette, State Dept. of Public Health, 309 State Office Bldg., Atlanta 3, Ga.

Apr. 8-10—Rochester, N. Y. *(Powers Hotel)*
N. Y. SECTION, A.W.W.A., Secy., Kimball Blanchard, 19 W. 50th St., New York 20, N. Y.

Apr. 9-11—Glendive, Mont. *(Jordan Hotel)*
MONTANA SECTION, A.W.W.A., AND MONTANA SEWAGE & INDUSTRIAL WASTES ASSN., Joint Meeting, Secy., Arthur W. Clarkson, State Board of Health, Helena, Mont.

Apr. 15-17—Lincoln, Neb. *(Cornhusker Hotel)*
NEBRASKA SECTION, A.W.W.A., Secy., Rupert C. Ott, Jr., Neptune Meter Co., 2818 - 21st St., Columbus, Nebr.

Apr. 16-18—Phoenix, Ariz. *(Westward Ho Hotel)*
ARIZONA SECTION, A.W.W.A., Secy., Stanford I. Roth, Div. of Water & Sewers, Phoenix, Ariz.

Apr. 22-24—Hutchinson, Kansas *(Baker Hotel)*
KANSAS SECTION, A.W.W.A., Secy., Harry W. Badley, Neptune Meter Co., 119 West Cloud, Salina, Kan.
(Jointly With)
KANSAS SEWAGE & INDUSTRIAL WASTES ASSN., Secy., James F. Aiken, Jr., 1900 East Ninth, Wichita, Kan.

Apr. 29-May 2—Long Beach, Calif. *(Hotel LaFayette)*
CALIFORNIA SEWAGE & INDUSTRIAL WASTES ASSN., Secy., Alfred Leipzig, 12000 Vista Del Mar, Venice, Calif.

May 3-6—Montreal, Can. *(Queen Elizabeth Hotel)*
CANADIAN SECTION, A.W.W.A., Secy., Dr. A. E. Berry, 72 Grenville St., Toronto, Ont., Can.

May 5-7—Lafayette, Ind. *(Purdue University)*
14TH PURDUE INDUSTRIAL WASTE CONF., Chairman, Prof. Don E. Bloodgood, Purdue University, Lafayette, Ind.

May 4-8—Cleveland, Ohio *(Hotel Cleveland)*
AMERICAN SOCIETY OF CIVIL ENGINEERS, Exec. Secy., W. H. Wisely, 33 W. 39th Street, New York 18, N. Y.

June 4-6—Tuscaloosa, Ala. *(Univ. of Alabama)*
ALABAMA WATER & SEWAGE ASSN., Secy., E. J. Finnell, Jr., University of Alabama, University, Ala.

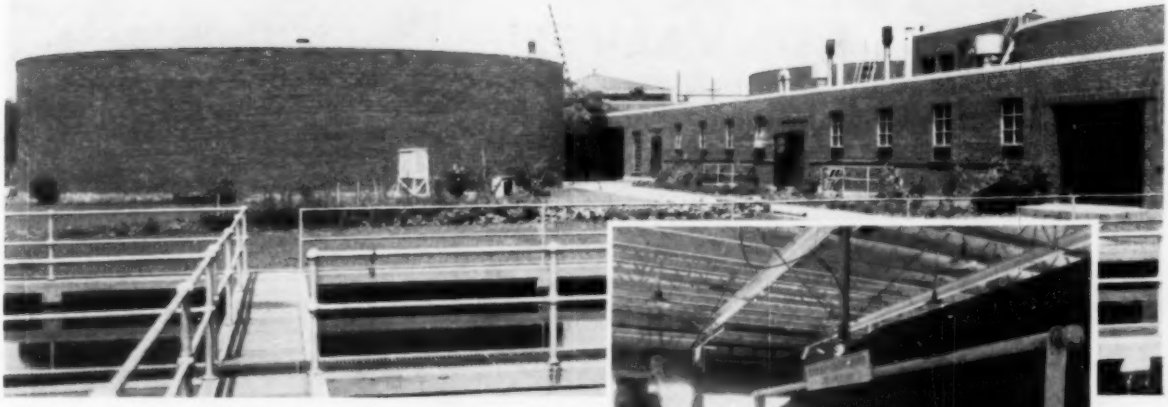
June 17-19—Cincinnati, Ohio *(Netherland Hilton Hotel)*
OHIO SEWAGE & INDUSTRIAL WASTES TREATMENT CONF., Secy., Cleamon E. Lay, Ohio Dept. of Health, 101 North High St., Columbus 15, Ohio

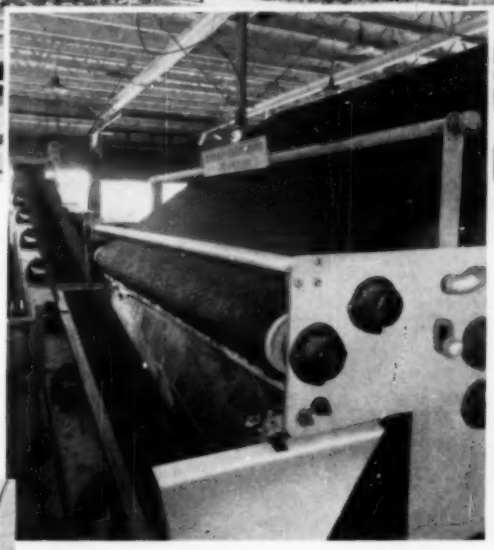
July 12-17—San Francisco, Calif. *(Civic Auditorium)*
A.W.W.A. CONVENTION, Secy., Harry E. Jordan, A.W.W.A., 2 Park Ave., New York 16, N. Y.

July 12-17—San Francisco, Calif. *(Civic Auditorium)*
CALIFORNIA SECTION, A.W.W.A., In Conjunction with National Convention, Secy., Roy E. Dodson, Jr., San Diego Water Dept., Balboa Park, San Diego 1, Calif.

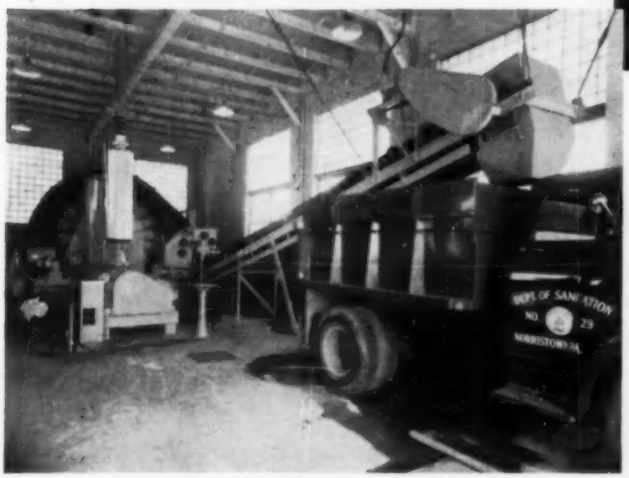
Another COILFILTER Case History

"First Aid" for Overworked Digesters





The 6,500,000 GPD Norristown, Penna., sewage treatment plant was placed in operation May 1, 1952. By the middle of 1953 population increase and industrial expansion had overloaded the plant's three digesters to the point that there were serious complaints about odor nuisance.



To solve this problem a 300 sq. ft. Komline-Sanderson COILFILTER was installed and placed in operation in July, 1954, working 7 days a week. Result — no more odors — no more overworked digesters — plenty of capacity for future growth. Present COILFILTER operation is 4 days per week. The plant's enclosed drying beds have not been used since the COILFILTER was installed.

Plant Superintendent: George H. Boone

KOMLINE-SANDERSON ENGINEERING CORPORATION

Peapack, New Jersey

MANUFACTURERS OF COILFILTER SLUDGE VACUUM FILTERS

Crispin

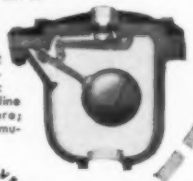
AIR VALVES

...keep pipelines open for safe, economical operation

Simplified construction, easy accessibility, maximum durability and efficient cost-saving operation are basic in every Crispin Air Valve.

Crispin UNIVERSAL AIR VALVES ... positive, full-time air control when line is filled, in operation or emptied.

Crispin AIR & VACUUM VALVES ... permit air to escape as line fills, allow air to enter as line empties.



Crispin PRESSURE AIR VALVES ... provide automatic air escape while line is under pressure; prevent air accumulation in line.

AIR CONTROL VALVES • FOR OVER 45 YEARS

multiplex

MANUFACTURING COMPANY

BERWICK, PENNSYLVANIA

Dept. B

Write, wire or phone for complete information on dependable Crispin Air Valves that keep your pipelines open for safe, economical operation.

GUNITE does it 2 times as fast at 1/2 the cost

"Gunite" is the modern process (sand and cement applied pneumatically) for repairing, constructing, lining:

- Reservoirs
- Dams
- Filter Plants
- Sewage Disposal Plants
- Tanks
- Stadiums
- Bridges
- Sea Walls
- Swimming Pools, etc.

WRITE FOR MORE INFORMATION, INCLUDING 48 PAGE "GUNITE" BOOKLET.

PRESSURE Concrete Co.

FLORENCE, ALA. 1555 Helton Street

OTHER OFFICES IN

CHICAGO, ILL. 30 W. Washington Street

NEWARK 5, N. J. 193 Emmet Street

New Bulletins

CONTINUED FROM PAGE 25A

standard type mixed drive mounted on a beam structure spanning either a rectangular or circular tank. Mixing is accomplished by turbine-type impellers attached to the vertical drive shaft which is suspended from the mixer drive and connected to a steady bearing on the tank floor. A circular perforated sparge ring is mounted near the floor beneath the impellers.

In operation, air supplied by a blower is admitted to the tank through the sparge ring perforations. Rising air bubbles are thoroughly dispersed and oxygen is absorbed as a result of the mixing, shearing action of the revolting impellers.

Process Equipment

1212

Hardinge Co. Inc., York, Pa., has just published an 8 page brochure on its complete line of process equipment for mining, chemical, stone, ceramics, water, sewage and industrial waste applications.

Equipment for the following process operations are included: agitating and mixing, balling or pelletizing, clarifying, wet and dry classifying, cooling, drying, filtering, feeding, flocculating, grinding or pulverizing, lime treating, sampling, ore scrubbing, heavy-media separating and thickening.

Laboratory or pilot-plant size equipment, for pulverizing and drying, is also described.

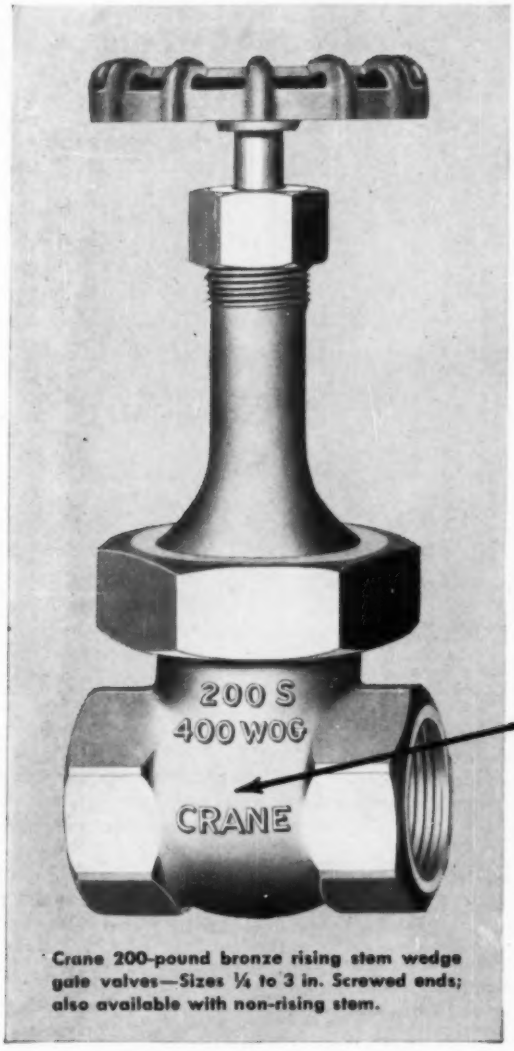
Submersible Pumps

1213

Stenberg Mfg. Corp., Hoosick Falls, N. Y., has published a bulletin describing their portable, fully submersible electric pumps for mining, contracting and general industrial use.

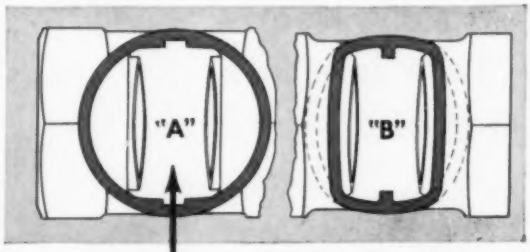
According to the bulletin one of the outstanding features of these pumps is their ability to handle a very high proportion of solids. In addition they will run for long periods without supervision, and will not suffer damage if allowed to run dry. Pumping starts again instantly when water

CONTINUED ON PAGE 102A



Crane 200-pound bronze rising stem wedge gate valves—Sizes ¼ to 3 in. Screwed ends; also available with non-rising stem.

Crane cylindrical body design ("A") distributes pressure load uniformly, resists distortion, prevents possibility of seat leakage under higher pressures. In ordinary, rectangularly shaped bodies ("B"), stresses concentrate where walls have shortest radius. Leakage and early failure may result from excessive deflection, and rupture may occur.



HERE

CRANE adds new strength and safety to 200-Pound Bronze Gate Valves

Here is a bronze gate valve body design that provides essential strength where internal pressures are greatest . . . where line strains are most likely to concentrate.

And that's not all you get. The Exelloy seat rings are expanded into the body so that they can't loosen. There are wider hex ends which give easier, firmer wrench grip and resist distortion.

Another quality feature that Crane offers is the shoulder at the bottom of the threads in port ends to restrain the excessive entry of pipe that could cause damage to the valve seats.

You will find many uses for Crane 200-pound bronze gate valves in your plant—on steam, water, oil, gas, air, gasoline, light oils and volatile fluid lines.

For complete information about these new Crane bronze valves, see your local Crane Representative, or write to address below for Circular Ad-2285.

Send for Circular Ad-2285 today.

CRANE VALVES & FITTINGS

PIPE • PLUMBING • KITCHENS • HEATING • AIR CONDITIONING

Since 1855—Crane Co., General Offices: Chicago 5, Ill.—Branches and Wholesalers Serving All Areas

Engineering PLUS...

Keeps Tank Interiors Corrosion Free at a Practical Cost

One of the five municipal tanks serving the City of Jacksonville, Fla. which has been cathodically protected by E.R.P. system since 1942.

The City of Jacksonville, Fla. has relied on engineering plus from Electro Rust-Proofing Corp. since 1942 to protect water storage tanks serving the city. Since installation of cathodic protection, tanks have been virtually corrosion free on the under water surfaces and maintenance costs have been reduced to a minimum.

E.R.P. engineering plus means cathodic protection systems
designed to meet your needs...
maintained to your benefit...
priced to your profit...

E.R.P. provides engineering plus to meet any corrosion problem of submerged or buried metals. For full information on cathodic protection for your water storage tanks, water treatment structures and pipelines, write for bulletin E-42.

ERP CATHODIC PROTECTION SINCE 1935

ELECTRO RUST-PROOFING CORP.
A SUBSIDIARY OF WALLACE & TIERNAN INC.
30 MAIN STREET, BELLEVILLE 9, NEW JERSEY
CABLE: ELECTRO, NEWARK, N. J.

E. R. P. CATHODIC PROTECTION
...INDIVIDUALLY DESIGNED FOR EACH APPLICATION
to prevent corrosion of buried or submerged metal structures
Write for Bulletin E-37
E-37

ELECTRO RUST-PROOFING CORPORATION
30 MAIN STREET, BELLEVILLE 9, N. J.

New Bulletins

CONTINUED FROM PAGE 100A

flows into the sump. FLYGT pumps will drain water down to an inch in depth, are easily moved around and require no suction hose or installation. The folder gives details of capacities, weights, hp, etc.

J-M Moulded Packings

1214

Johns-Manville, New York, N. Y., has just published a concise 12-page catalog on moulded packings that offers the type of information a designer wants to know about the selection and installation of sealing devices for pneumatic and hydraulic equipment.

Condensation Prevention

1215

J. W. Mortell Co., Kankakee, Ill., has available a 32-page handbook that gives complete general and technical data on condensation and corrosion.

Benefits of Asbestos-Cement Pipe

1216

Keasbey & Mattison Company, Ambler, Pa., has just published a brochure which presents the advantages and features of asbestos-cement pipe and stresses the importance of "clear, full-flowing water—a community's most important asset!"

Motor Instruction Manual

1217

To help pump dealers and maintenance men to save time and needless procedures in installing, inspecting, and servicing its Verticlosed pump motors, U. S. Electrical Motors, Inc., Los Angeles, Calif., has just published a liberally illustrated and charted Instruction Manual covering both Verticlosed Type CFU, Oil-Lubricated, and Type SCU, Grease-Lubricated Motors. It outlines in careful, easy-to-understand steps various factory-developed procedures that are designed to minimize the dealer's and maintenance man's servicing efforts.

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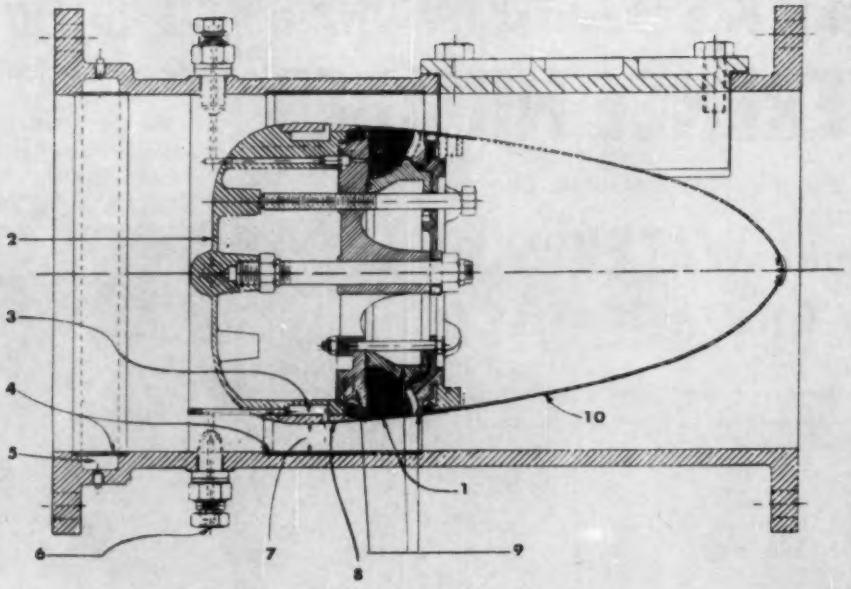


1. *Only moving part* is this modulator.
2. Nose piece.
3. Multi-piezometer low-pressure chamber.
4. Housing liner.
5. Multi-piezometer high-pressure chamber.
6. Low-pressure connection.
7. Annular throat.
8. Throat ring.
9. Modulair assembly—clamping ring, spacer, and holding ring.
10. Head recovery section.

Maintenance is nil

because only one part moves in the new Modulair Flow Controller

Take the moving parts out of a rate-of-flow controller and you've taken away practically all your maintenance—and that's just what you can do with this new Simplex Modulair Flow Controller.

The only moving part inside your pipeline is a non-corroding rubber throttle.

There are no line valves, no pilot valves, no pistons or valve shafts. Not even a stuffing box to pack.

Installs like a piece of pipe. You can install a Modulair in about the time it takes to plumb a piece of pipe. It comes as a completed unit.

New bulletin. Bulletin WS-128 explains the Modulair design in greater detail and shows pictures of installations where Modulair has been in actual filter plant operation for over seven years.

SIMPLEX®
VALVE AND METER COMPANY
a subsidiary of PFAUDLER PERMUTIT INC.
LANCASTER, PENNSYLVANIA

See the 1958
WATER & SEWAGE WORKS
REFERENCE NUMBER

For the latest complete information

about **WATER SUPPLY**
and **SEWAGE DISPOSAL**

These industry leaders have interesting, informative messages in this great issue:

Ace Pipe Cleaning Co.
Alabama Pipe Co.
Allis-Chalmers
Amercoat Corp.
American Vitrified Products Co.
American Well Works
Anthracite Equipment Corp.
Bailey Meter Company
Beaumont Birch Co.
Bethlehem Steel Company
B-I-F Industries, Inc.
Blackburn-Smith Mfg. Co., Inc.
Borden Metal Products Co.
Bremer Brease, Inc.
Builder-Providence, Inc., Div. of B-I-F Industries, Inc.
Chain Belt Company
Chicago Bridge & Iron Company
Chicago Pump Company
Climax Engine Co.
Clow, Jas. B. (Iowa Valve Co.)
Columbia Southern Chemical Div.
Combustion Engineering, Inc.
Cook Well Strainer Co.
DeZurik Corp.
Dorr-Oliver Inc.
Eimco Process Engineers, Inc.
Fine Organics, Inc.
Fischer & Porter Co.
Foster Engineering Co.
Frontier Chemical Co.
General Chemical Div. Allied Chemical Corp.
General Filter Co.
Golden Anderson Valve Specialty Co.
Graver Tank & Mfg. Co., Inc.
Graver Water Conditioning Co.
Hamilton Kent Mfg. Co.
Hardinge Company, Inc.
Infilco Inc.
International Minerals & Chemical Corp.
Iowa Valve Co.
Jeffrey Manufacturing Company, The
Johns-Manville
Jones Co., John Wiley
Kamline-Sanderson Engineering Corp.
Link-Belt Company
Ludlow Valve Mfg. Co., The
M & H Valve & Fittings Company
Merrick Scale Mfg. Co.
Multiplex Manufacturing Co.
Natco Corp.
National Clay Pipe Manufacturers, Inc.
National Power Rodding Corp.
Neptune Meter Co.
Nichols Engr. & Res. Corp.
Olin Mathieson Chemical Co.
Omega Machine Co., Div. of B-I-F Industries, Inc.
Pacific Flush Tank Co.
Pennsalt Chem. Corp. (West Div.)
Permutit Company
Phelps Dodge Refining Corp.
Philadelphia Quartz Co.
Phipps & Bird, Inc.
Pittsburgh-Des Moines Steel Co.
Pratt, Henry, Co.
Precision Chemical Co.
Preload, Inc.
Proportioneers, Inc., Div. of B-I-F Industries, Inc.
Rensselaer Valve Co.
Roberts Filter Mfg. Co.
Robinson Pipe Cleaning Co.
Schramm, Inc.
Shahmoon Industries, Inc.
Simplex Valve & Meter Co.
Smith-Blair, Inc.
Smith & Loveless, Inc.
Smith Mfg. Co., A. P.
Standard Steel Corp.
Tennessee Corporation
U. S. Pipe & Foundry Co.
Vulcan Materials Co.
Walker Process Equip. Inc.
Wallace & Tiernan, Inc.
Washington Aluminum Co.
Water Seals, Inc.
Wheeler Mfg. Co., C. H.
Wheeler Mfg. Corp., The
White Diesel Eng. Div.
Worthington Corp.
Yeomans Brothers Co.

SCRANTON PUBLISHING CO., INC.
185 N. Wabash Ave., Chicago 1, Ill.
155 E. 44th St., New York 17, N. Y.

New Bulletins

CONTINUED FROM PAGE 102A

Residual Chlorine Analyzer

1218

Fischer & Porter Co., Hatboro, Pa., has just published a technical publication on their Residual Chlorine Analyzer, a double light beam filter photometer for continuous measurement of free, combined, or total residual chlorine in water or sewage.

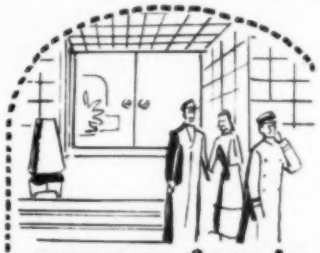
Full description, technical details and specifications are also included.

Check Chart For Maintenance Painting

1219

The Wilbur & Williams Co., Brighton, Mass., has just issued the fourth edition of its famous Check Chart to bring up to date the latest technical recommendations on selecting the right paint for maintenance problems.

CONTINUED ON PAGE 106A



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AN INTERNATIONAL HOTEL
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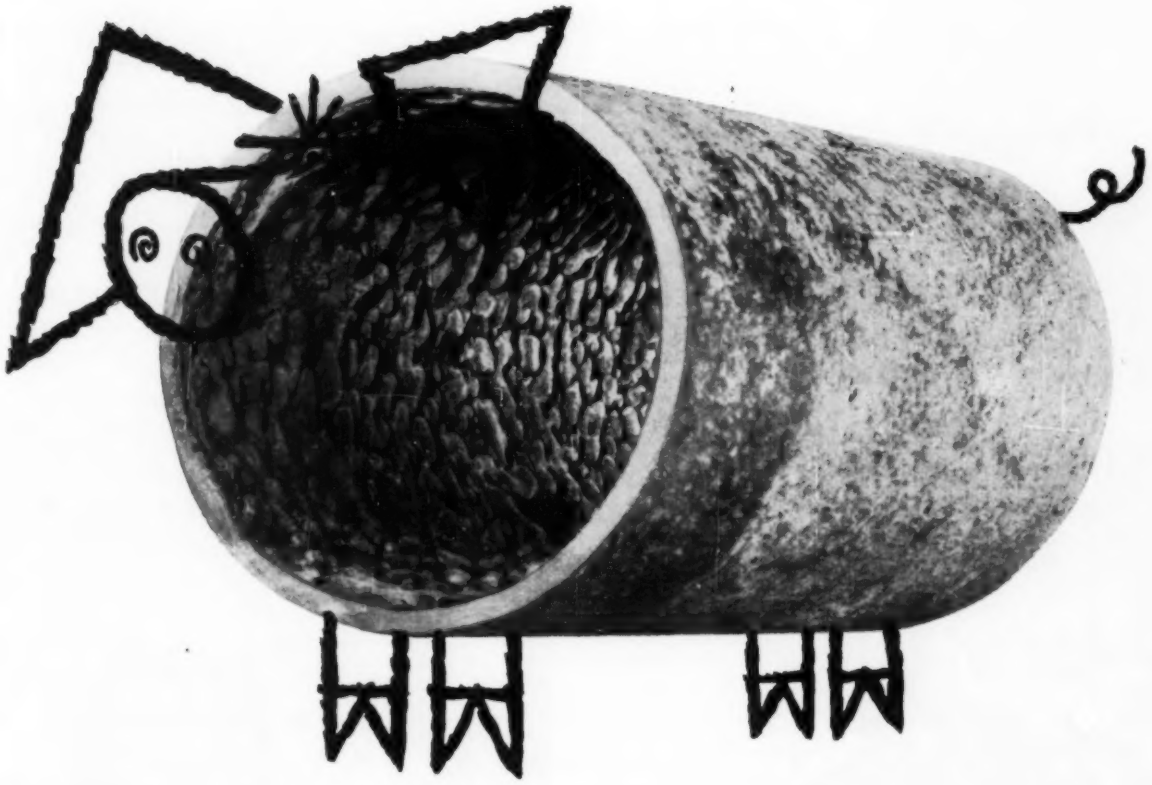
portrait of a power hog



When water flow capacities go down and pumping costs go up, the culprit is usually *tuberculation*. The way to deal with this power hog is right on his own ground — the inner surface of the water main. Here Calgon,® the simple and inexpensive way to deal with corrosion,† goes to work. By interposing a tough film between the metal surface and water, Calgon definitely controls corrosion.

Calgon treatment of the water is particularly effective after mechanical main cleaning because of its fast film-forming ability. Protection for freshly scored metal surfaces is quickly built up and easily maintained. Calgon treatment is as inexpensive as it is effective — a few ppm control tuberculation and other corrosion problems as well.

A letter or phone call will bring you more information on how Calgon can help. Or, an experienced Calgon engineer will be glad to make detailed recommendations on your specific problem.

CALGON COMPANY

DIVISION OF **HAGAN** CHEMICALS & CONTROLS, INC.
HAGAN BUILDING, PITTSBURGH 30, PENNSYLVANIA
DIVISIONS: CALGON COMPANY, HALL LABORATORIES
IN CANADA: HAGAN CORPORATION (CANADA) LIMITED, TORONTO

†Fully licensed under U.S. Patent 2337856

MECHANICAL EQUIPMENT BY ROBERTS FILTER MFG. CO. DARBY, PENNA.

Synonym for...

PURE WATER

ROBERTS FILTER
MANUFACTURING CO.
607 COLUMBIA AVE.
DARBY, PA.

New Bulletins

CONTINUED FROM PAGE 104A

Liquid Level Controls

1220

B/W Controller Corp., Birmingham, Mich., has released a new catalog describing the B/W system of Liquid Level Control which operates without floats and with no moving parts in the liquid. The catalog covers

Magnetic and Motorized Valves

1221

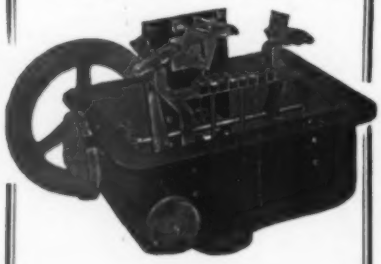
The Mercoid Corp., Chicago, Ill., has just released a 24-page catalog that illustrates and lists specifications of magnetic and motorized valves for use with air, water, gas, steam, oil and refrigerants. Also included are solenoid coil rating tables.

Rubber Expansion Joints and Flexible Pipe

1222

General Rubber Corp., Tenafly, N. J., has just released a new 6-page, 2-color bulletin giving complete information on their new line of high quality Rubber Expansion Joints and Flexible Pipe.

ROTO-TROL



RF-2

WITH ALTO-TROL

This 2-pump RF-2 Roto-Trol assures equal use and wear of both pumps. Each pump is operated on alternate starting cycles.

The RF-2 operates both pumps together, when required. RF-2 installations give dependable service year after year, with the minimum of attention.

Write for full data

WATER LEVEL CONTROLS DIVISION
HEALY-RUFF COMPANY
783 Hampden Ave., St. Paul 4, Minn.

WATER DISTRIBUTION SYSTEM
ASSISTANT DISTRICT SUPERVISOR

Assists in supervising crews maintaining & repairing the city water distribution system. Requires 4 years exp., including 1 year as a supervisor, in installing & repairing water mains & appurtenances. Starting salary is approx. $89 per week with regular increases, job stability, liberal fringe benefits. Send answering letter to

Miss Alma Goldman
975 City Hall, Philadelphia 7, Penn.

SITUATION WANTED

Many years experience water filtration plants, lime soda sludge units, clarifiers, softeners, swim pools, iron removal etc., and sewage plants. Can take charge or am willing to operate as assistant. Former employe large leading manufacturer of equipment for water and sewage systems. Experienced venturi meters, rate controllers, rate & loss of head gauges, chemical feeders, slakers chlorine apparatus. Chemistry water and sewage knowledge, expert on filter problems, salary not too important, if reasonable, and within 100 miles radius Chicago. Age 56 years.

Box 2000, Water & Sewage Works
185 N. Wabash Ave., Chicago 1, Ill.

MUNICIPAL SUPPLIES
50 Years
W. S. DARLEY & CO.

Write Today For 100 Page Catalog
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WANTED
Experienced Engineers

to prepare plans for sanitary sewers and water systems, sewage and water treatment plants. Unusual opportunities for professional advancement and independent practice. State age, experience, education, when can report, salary required.

Box 2001, Water & Sewage Works
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... featuring convenience, comfort, quality! A cosmopolitan atmosphere in home-like setting. In the center of all downtown activities. Newly decorated. Ultra modern, comfortable guest rooms ... excellent food at moderate prices in our modern coffee shop and cafeteria.

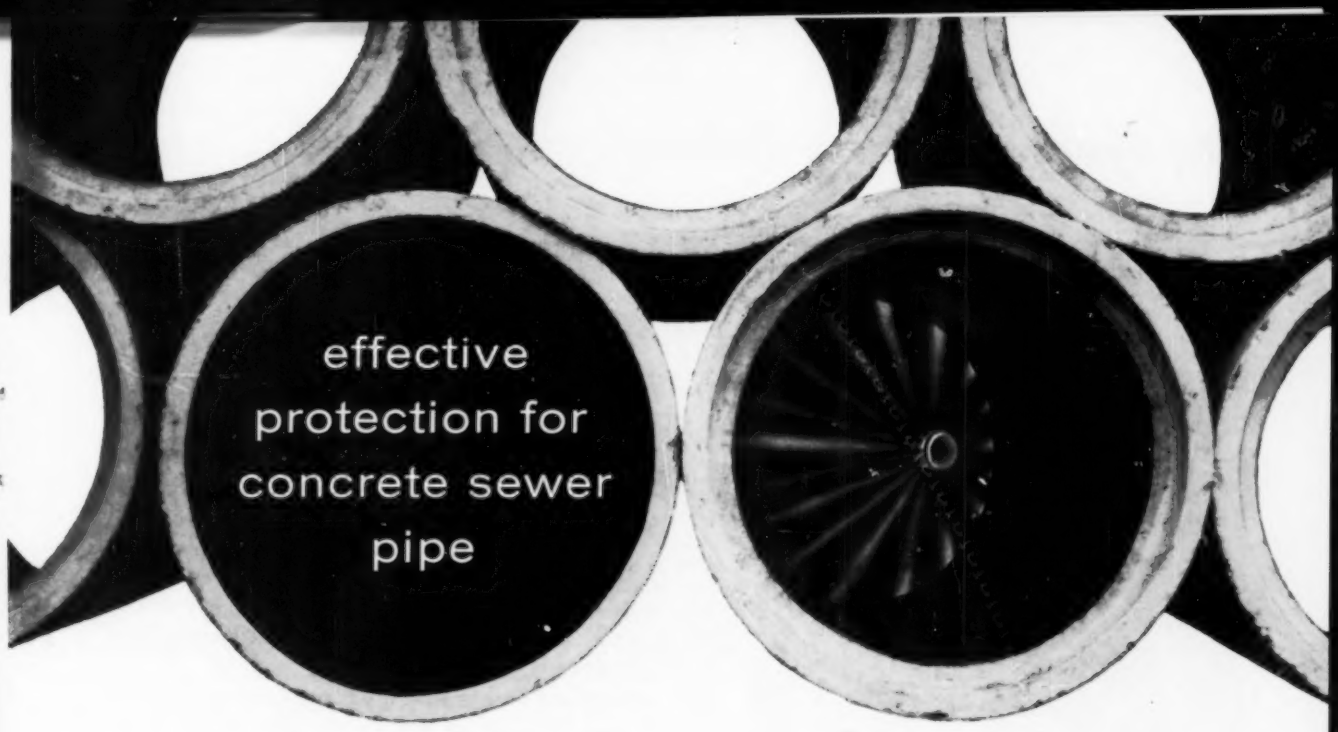
Radio and Television in room. Air Conditioned rooms in season.

800 ROOMS WITH BATH from $4

GARAGE available at nominal charge. Free overnight parking for registered guests in PARKING LOT.

FAMILY RATES
No Charge for Children 12 and Under —

Harry E. Paulsen, General Manager
FACING GRAND CIRCUS PARK
DETROIT



Easily applied internal coatings of Copon Arocoat prevent pipe deterioration caused by sewage products

Now, you can easily prepare concrete pipe for sewage applications. For internal coatings of Copon Arocoat can be quickly, economically applied with spray equipment . . . provide positive, permanent protection against the destructive action of hydrogen sulfide and other chemicals present in sewage.

A combination of epoxy and coal tar resins, Copon Arocoat coatings have been used to solve many of industry's toughest corrosion problems. Underground, they remain tough and elastic despite temperature extremes . . . do not deterioriate. Other successful pipe applications include submerged, buried and exposed transmission lines.

Investigate use of Copon Arocoat for protection of sewer pipe and other concrete surfaces. Write today to the Copon Associate located nearest to your city.

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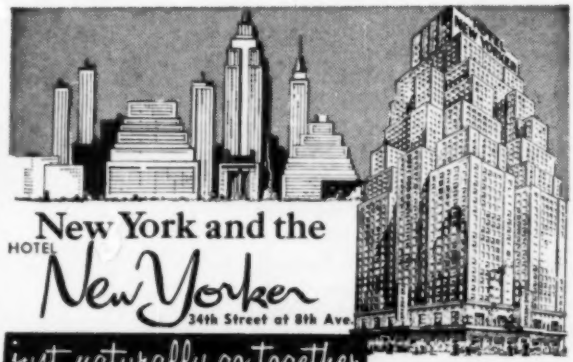

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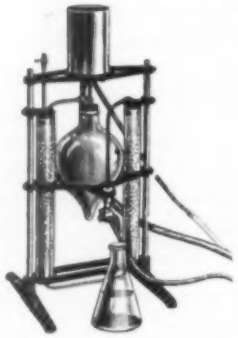

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Advertisers Index

A

*Alabama Pipe Co. 5A
*Amercoat Corp. 97A
American Pipe & Construction Co. 16A
*Anthracite Equipment Corp. 112A

B

Badger Meter Mfg. Co.
*B-I-F Industries, Inc. Back Cover
*Builders-Providence, Inc. Back Cover
Byers Co., A. M. 36A

C

Calgon Co. 105A
Carborundum Co. 30A
Cast Iron Pipe Research Ass'n. 14A-15A
Centriline Corp. 11A
*Chicago Bridge & Iron Co. 21A
*Chicago Pump Company 95A
*Cleveland Trencher Co., The 27A
*Clow & Sons, James B. 18A-19A
Consulting Engineers 109A-110A-111A
Copon Associates 107A
Crane Co. 101A

D

Darley & Co., W. S. 106A
*DeZurik Shower Company
*Dorr-Oliver Inside Back Cover

E

Electro-Rust Proofing Corp. 102A

F

*Fischer & Porter Co. 41A
Ford Meter Box Co. 20A
Foxboro Co. 46A

G

General Amer. Trans. Corp. 108A
Grinnell Co. 98A

H

*Hamilton Kent Mfg. Co. 28A
Healy-Ruff Company 106A
Hersey Manufacturing Company 37A

I

*Iowa Valve Co. 12A

J

*Jeffrey Mfg. Co. 44A
Johns-Manville 34A-35A

K

*Komline-Sanderson Engr. Corp. 99A
Kuhns Bros. Co. 13A

L

Layne & Bowler, Inc. 38A
*Leopold & Co., F. B. 31A

M

*M & H Valve & Fittings Co. 25A
*Mueller Company 10A-45A
*Multiplex Mfg. Co. 100A

N

*National Clay Pipe Mfrs., Inc. 1A
*Neptune Meter Company 48A
Newport News Shipbuilding Dry & Dock Co. 42A

P

*Pacific Flush Tank Company 26A
*Permutit Company 2A
*Phipps & Bird, Inc. 112A
*Pittsburgh Des Moines Steel Co. 24A
Portland Cement Ass'n. 40A
*Pratt Co., Henry 4A
*Precision Chem. Corp. 6A
*Preload Company 43A
Pressure Concrete Co. 100A
Price Bros. Company 39A

R

*Roberts Filter Co. 106A

S

*Simplex-Valve & Meter Co. 103A
Standard Dry Wall Products Co. 29A

U

*U. S. Pipe & Foundry Co. 32A-33A
U. S. Rubber 8A

W

Weinman Pump Mfg. Co. 96A
Westinghouse Electric Co. 22A-23A
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